Liikennevirasto

49 • 2015

LIIKENNEVIRASTON
TUTKIMUKSIA JA SELVITYKSIÄ

JUSSI KINNUNEN

Ajan vaikutus kitkapaalujen geotekniseen kestävyyteen

Jussi Kinnunen: Ajan vaikutus kitkapaalujen geotekniseen kestävyyteen.

Avainsanat:

Jussi Kinnunen: Tidsrelaterad ökning i bärförmåga av friktionspålar.

Nyckelord:

Jussi Kinnunen: Time-related increase in bearing resistance of friction piles.

Keywords:

b

c

min

pl

s

s;i

D_{CPT}

D_r

d_{50}

f_{ck}

$F_{c;lyönti}$

$f_{c;o;k}$

f_s

$F_{t;lyönti}$

f_{yk}

c

c

φ

Q_0 t_0

b

b;k

c

c;b

c;i

s;i;k

;cal

;k

R_{cla}

;cal

;d

;k

;m

k;geo;max

;cal

s;k

R^*

t_0

$t_{0;c}$

t_1

t_2 $t_1 + 2L/C)$

t_3 $2L/_C$

t_0

T_{50}

α

α_i

$\Delta\sigma'_r$

$\Delta\sigma'_{rd}$

$\Delta\sigma'_{rp}$

δ_{cv}

δ_f

$\bar{\delta}$

σ

σ

σ

σ

σ

τ_f

γ_b

γ_s

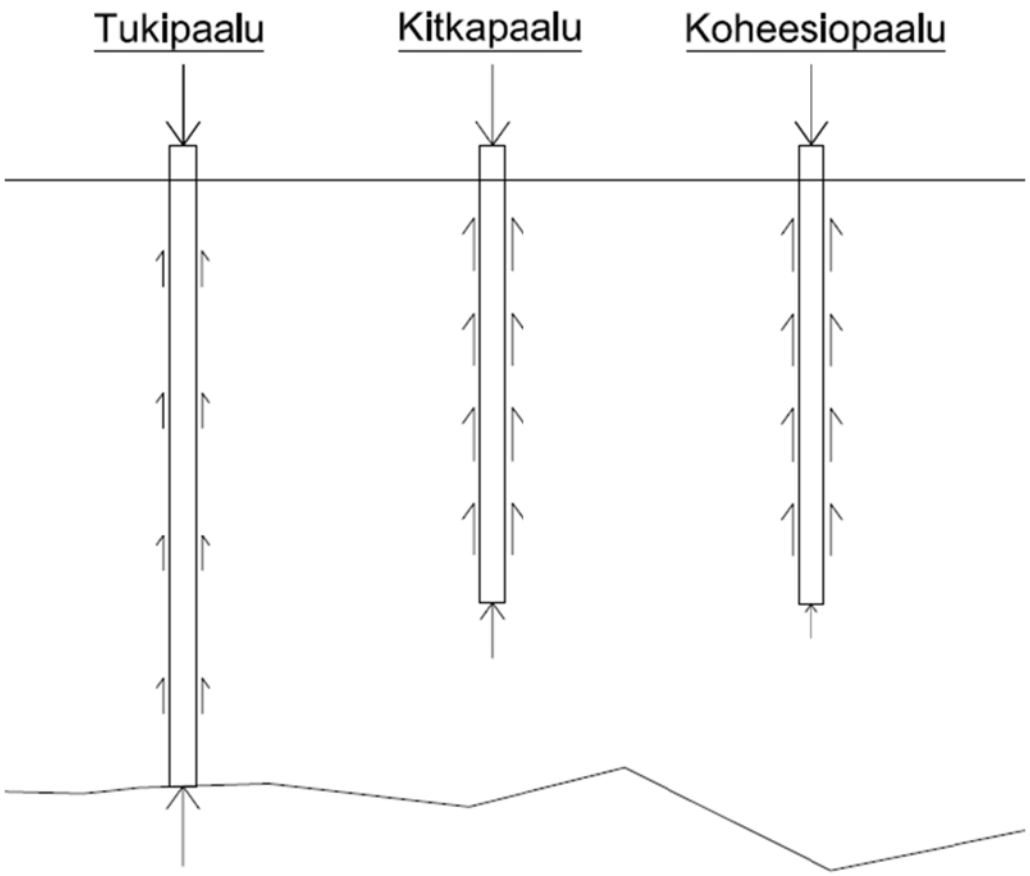
ξ_3; ξ_4

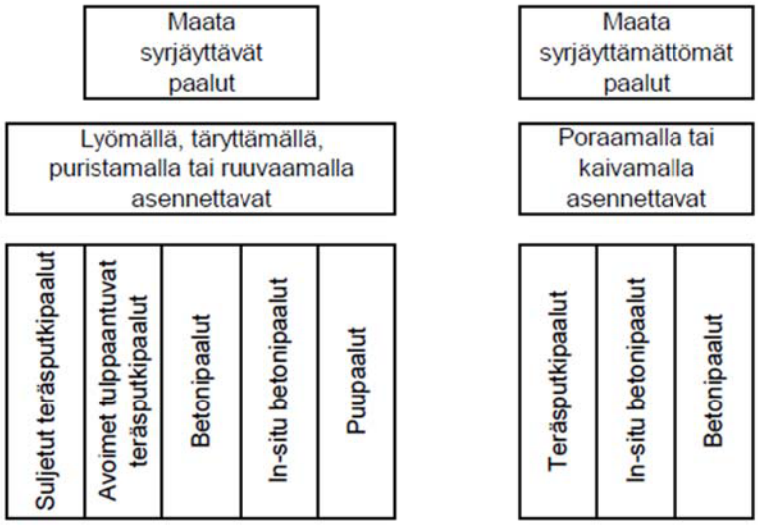
ξ_5; ξ_6

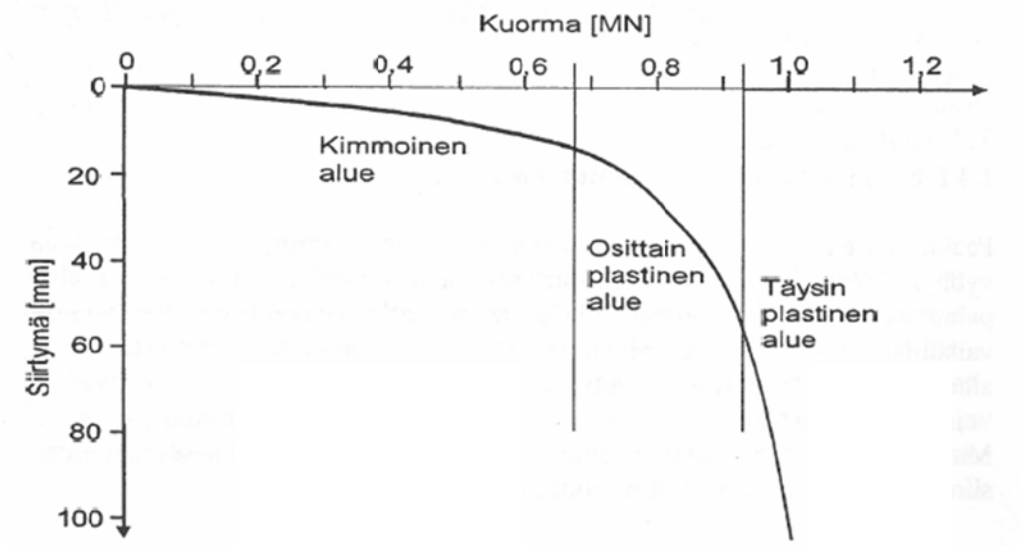
ϕ

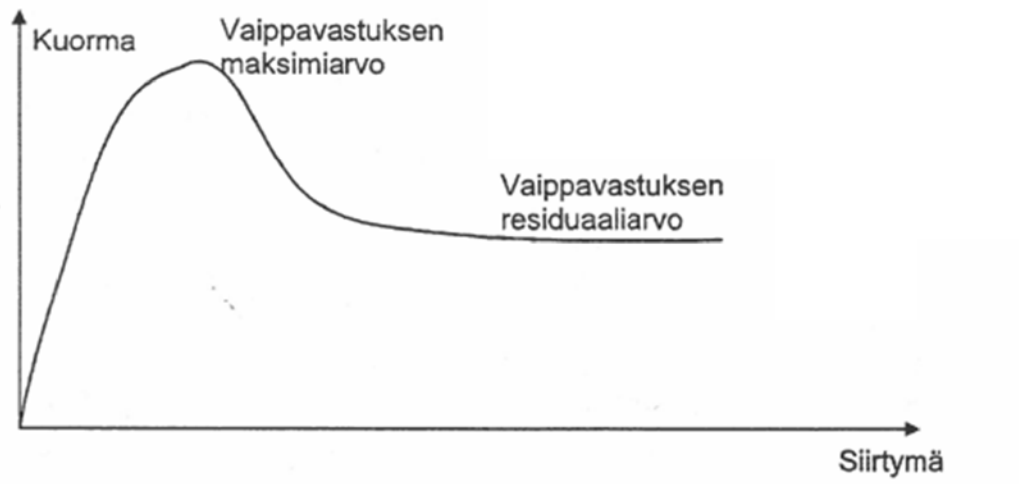
1 Johdanto

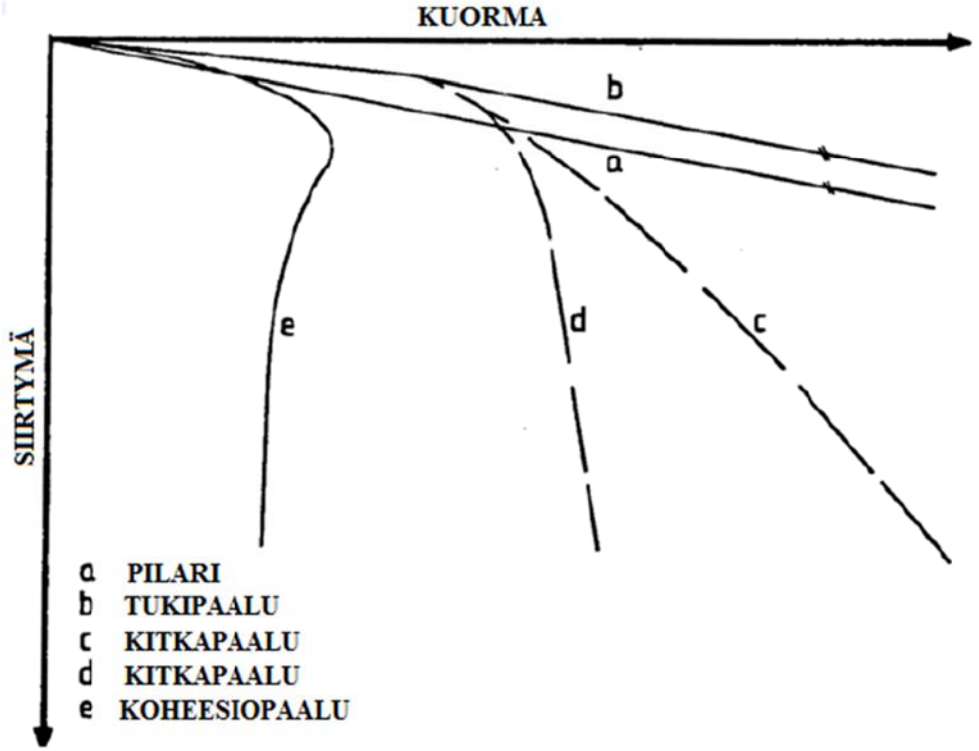
2 Paalun ja maan yhteistoiminta



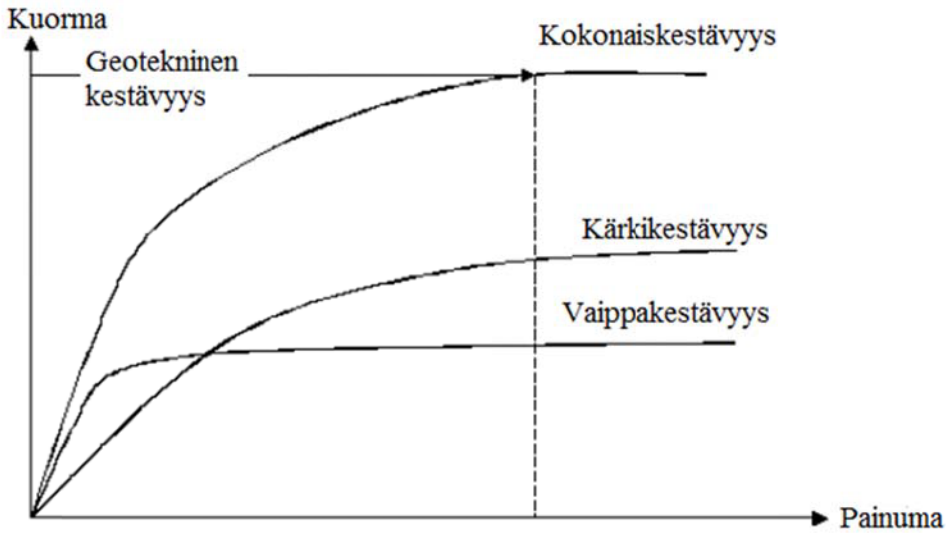

Maata syrjäyttävät paalut
Maata syrjäyttämättömät paalut
Lyömällä, täryttämällä, puristamalla tai ruuvaamalla asennettavat
Poraamalla tai kaivamalla asennettavat
Suljetut teräsputkipaalut
Avoimet tulppaantuvat teräsputkipaalut
Betonipaalut
In-situ betonipaalut
Puupaalut
Teräsputkipaalut
In-situ betonipaalut
Betonipaalut

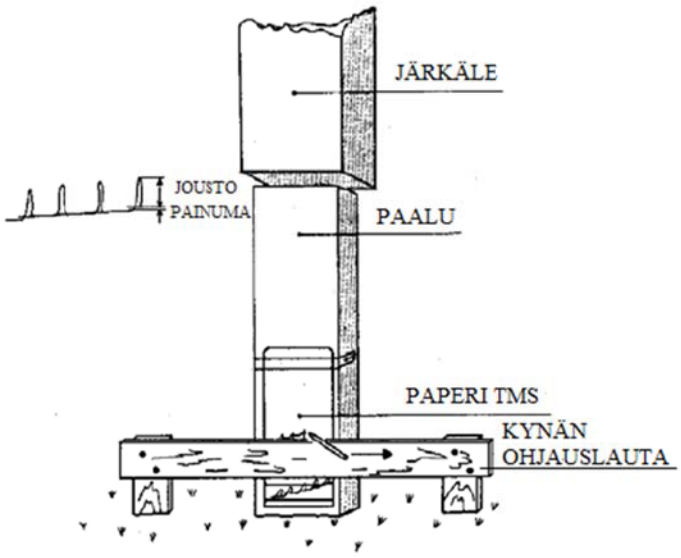

Kuorma [MN]
0
0,2
0,4
0,6
0,8
1,0
1,2
0
20
40
60
80
100
Siirtymä [mm]
Kimmoinen alue
Osittain plastinen alue
Täysin plastinen alue


Kuorma
Vaippavastuksen maksimiarvo
Vaippavastuksen residuaaliarvo
Siirtymä


KUORMA
SIIRTYMÄ
b
a
e
d
c
a PILARI
b TUKIPAALU
c KITKAPAALU
d KITKAPAALU
e KOHEESIOPAALU

$s_c \geq$


Kuorma
Geotekninen kestävyys
Kokonaiskestävyys
Kärkikestävyys
Vaippakestävyys
Painuma


JÄRKÄLE
JOUSTO
PAINUMA
PAALU
PAPERI TMS
KYNÄN
OHJAUSLAUTA

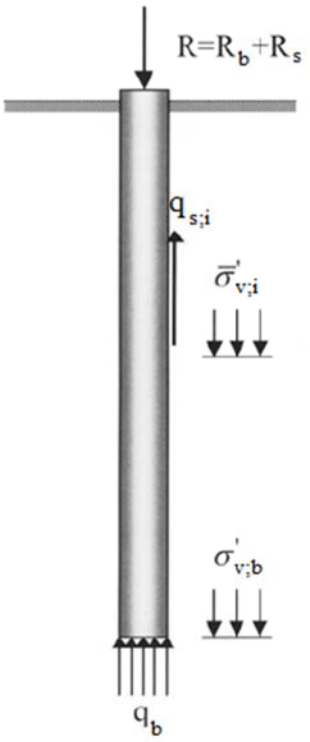
3 Pohjatutkimustuloksiin perustuva paalun geoteknisen puristuskestävyyden määritys Suomessa

;cal ;cal ;cal

;cal

;cal

;cal



β

Maalaji		Puristin-kairaus q_c [MPa]	Paino-kairaus Pk/0,2 m	Heijari-kairaus L/0,2 m	Moduuli-luku m	Jännitys-eksponentti β	Kitka-kulma
Karkea siltti	Löyhä Keskitiivis Tiivis	< 7 7–15 > 15	< 40 40–100 > 100	< 8 8–25 > 25	30–100 70–150 100–300	0,3 0,3 0,3	28 30 36
Hieno-hiekka $d10$<0,06	Löyhä Keskitiivis Tiivis	< 10 10–20 > 20	20–50 50–100 > 100	5–15 15–30 > 30	50–150 100–200 150–300	0,5 0,5 0,5	30 33 36
Hiekka $d10$>0,06	Löyhä Keskitiivis Tiivis	< 6 6–14 > 14	10–30 30–60 > 60	5–12 12–25 > 25	150–300 200–400 300–600	0,5 0,5 0,5	32 35 38
Sora	Löyhä Keskitiivis Tiivis	< 5,5 5,5–12 > 12	10–25 25–50 > 50	5–10 10–20 > 20	300–600 400–800 600–1200	0,5 0,5 0,5	34 37 40
Moreeni	Hyvin löyhä Löyhä Keskitiivis Tiivis	< 10 > 10	< 40 40–100 > 100 Lyömällä	< 20 20–60 60–140 > 140	150–600 600… 800… 1200…	0,5 0,5 0,5 0,5	…34 …36 …38 …40

3.2.1 Paalun kärkikestävyys

. .

b σ .

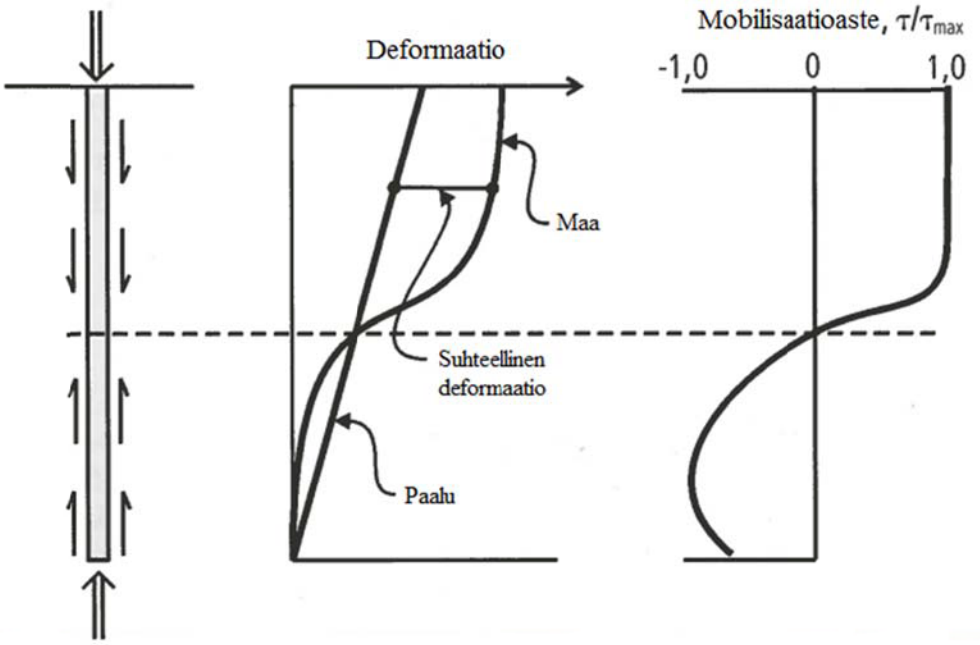
;cal b · b

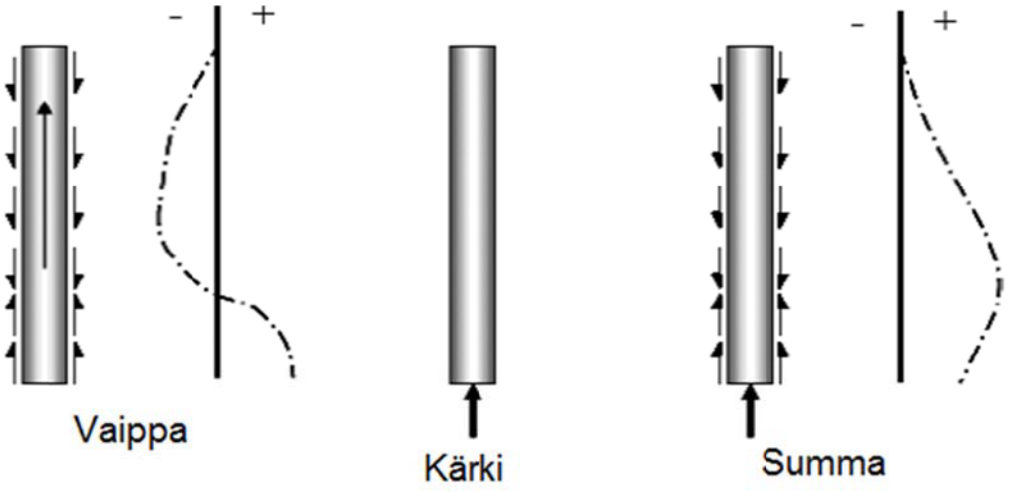
b

b

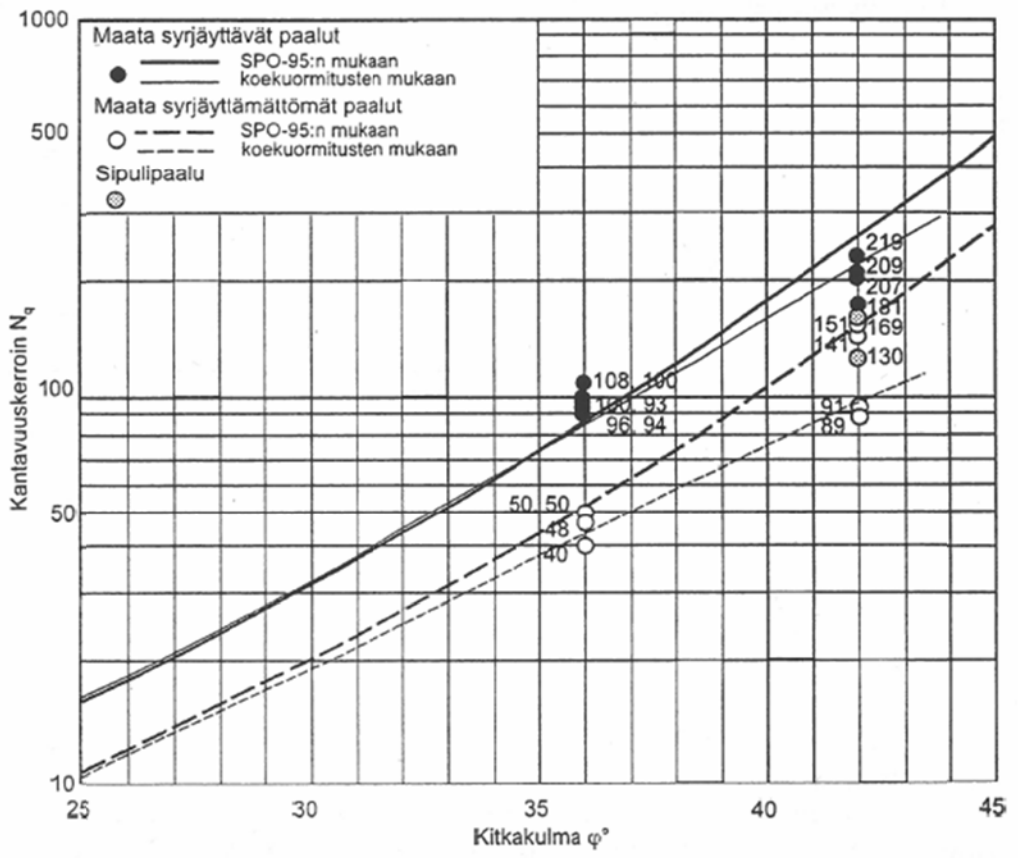
σ

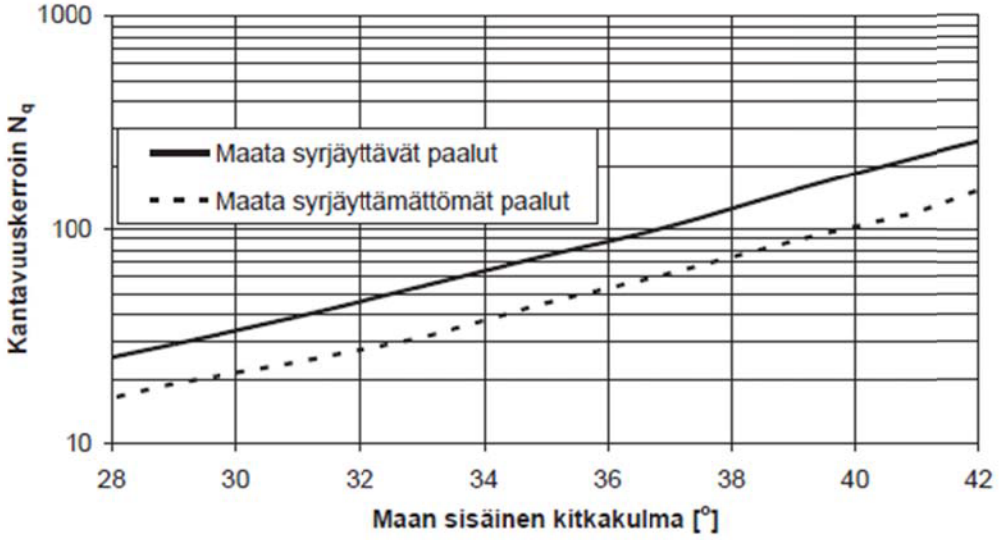
σ


Deformaatio
Mobilisaatioaste, τ/τ_{max}
-1,0
0
1,0
Maa
Suhteellinen
deformaatio
Paalu



Residuaalijännitykset


Maata syrjäyttävät paalut
SPO-95:n mukaan
koekuormitusten mukaan
Maata syrjäytlämättömät paalut
SPO-95:n mukaan
koekuormitusten mukaan
Sipulipaalu
1000
500
100
50
10
Kantavuuskerroin N_q
25
30
35
40
45
Kitkakulma φ°
219
209
207
181
169
130
108
100
96
94
50
50
48
40
89


1000
100
10
Kantavuuskerroin N_q
Maata syrjäyttävät paalut
Maata syrjäyttämättömät paalut
28
30
32
34
36
38
40
42
Maan sisäinen kitkakulma [°]

3.2.2 Paalun vaippakestävyys

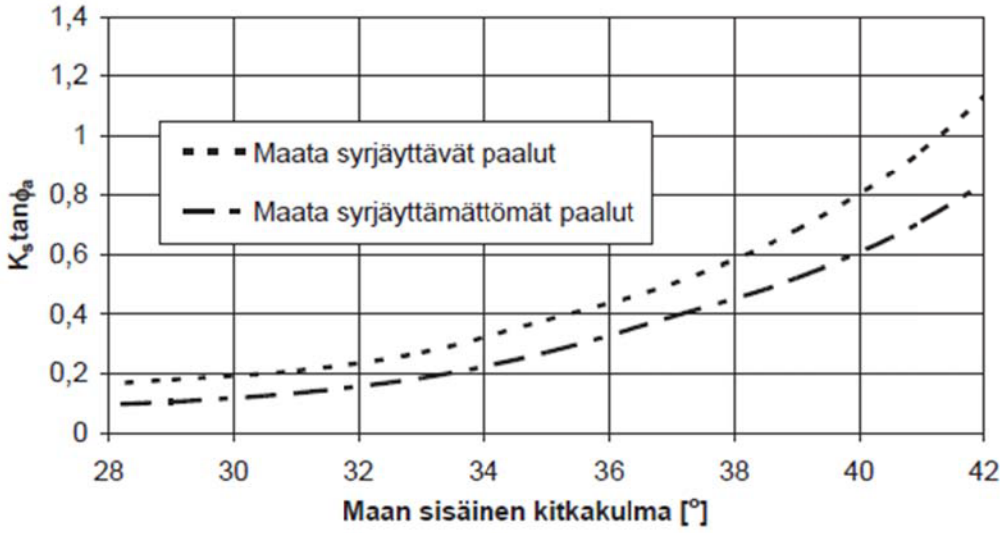
$_{s;i;k}$ σ $\cdot K_s \tan\varphi_a$

$_{s;k}$ Σ $_{s;i}$ $\cdot$ $_{s;i;k}$

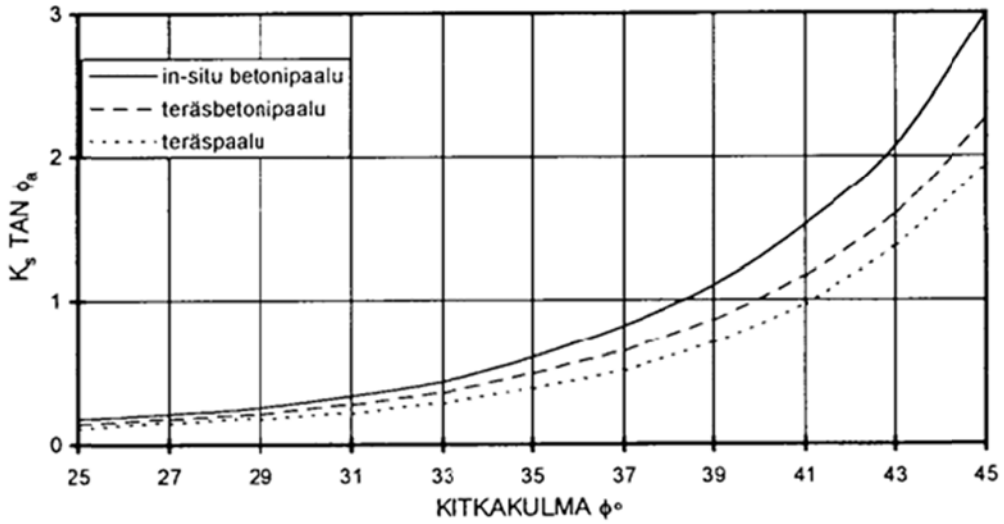
$_{s;i;k}$
$_{s;i}$
$_{s;k}$
φ
σ

σ
.

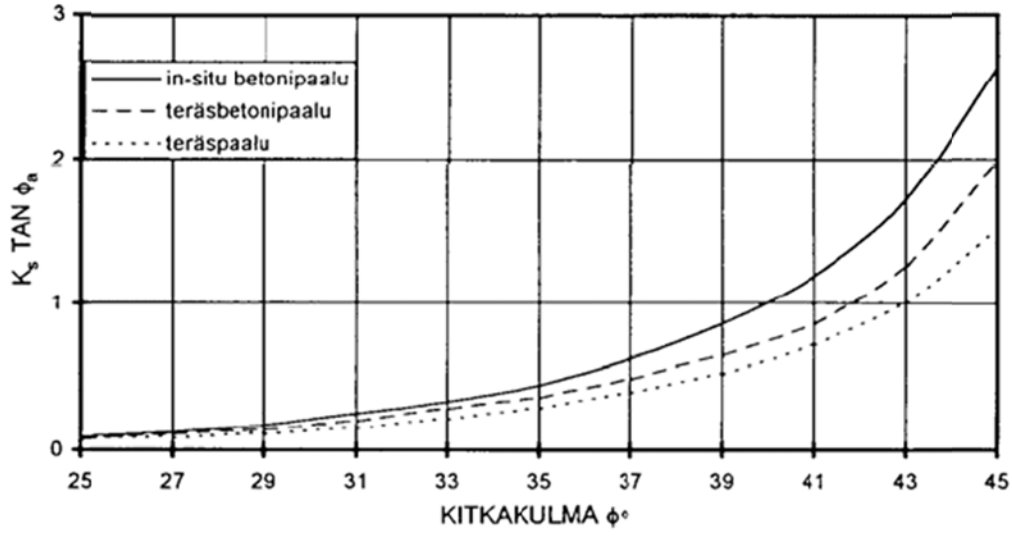
$K_s \tan\varphi_a$



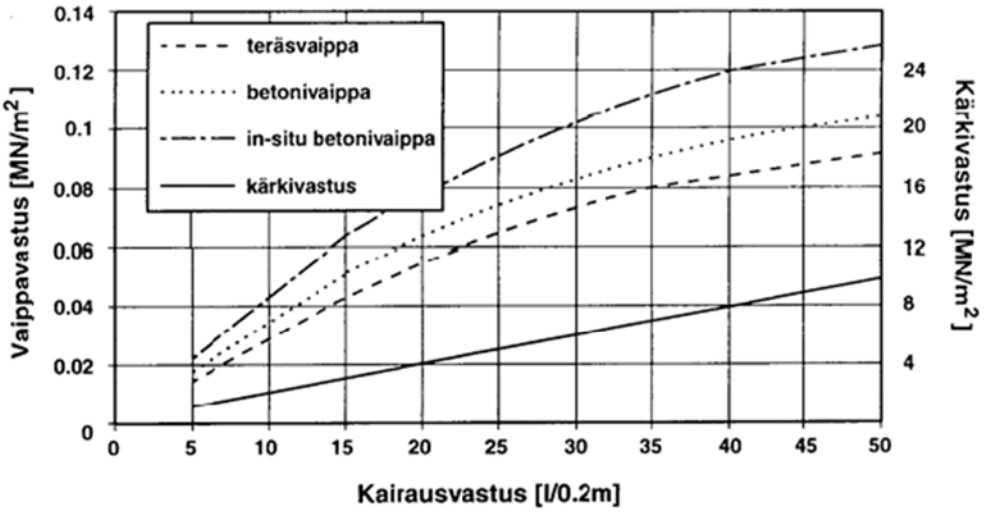
$K_s \tan\varphi_a$

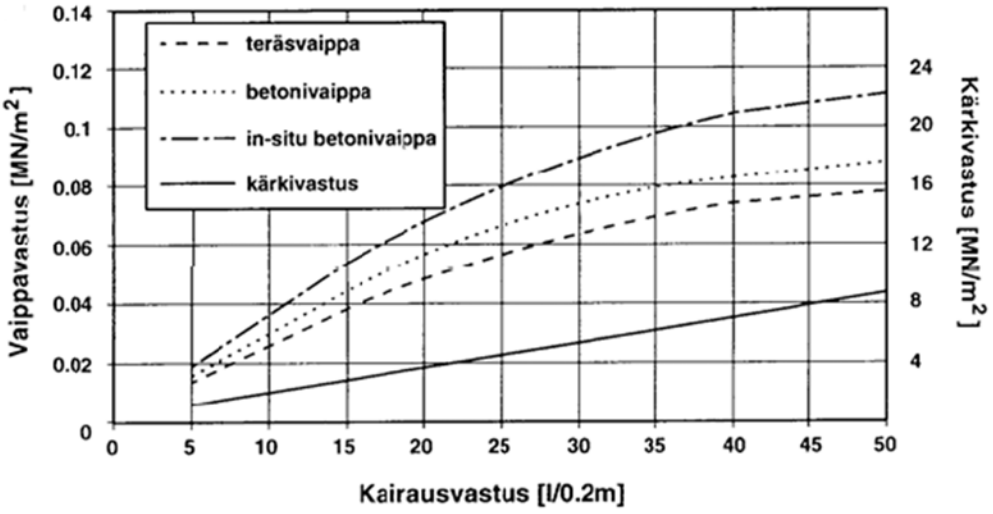


φ



φ


teräsvaippa
betonivaippa
in-situ betonivaippa
kärkivastus
Vaippavastus [MN/m2]
Kärkivastus [MN/m2]
Kairausvastus [l/0.2m]
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
24
20
16
12
8
4
0
5
10
15
20
25
30
35
40
45
50



b;k .

b;k .

b;k

$$q_{s;i;k} = \frac{\sin\left(\left(1-\frac{N_{20}}{300}\right)\cdot N_{20}\right)\cdot\cos\left(\left(1-\frac{N_{20}}{300}\right)\cdot N_{20}\right)}{4{,}85}$$

$$R_k = q_{c;b}\, k_c\, A_b + \sum\left(\frac{q_{c;i}}{\alpha_i}\, A_{s;i}\right.$$

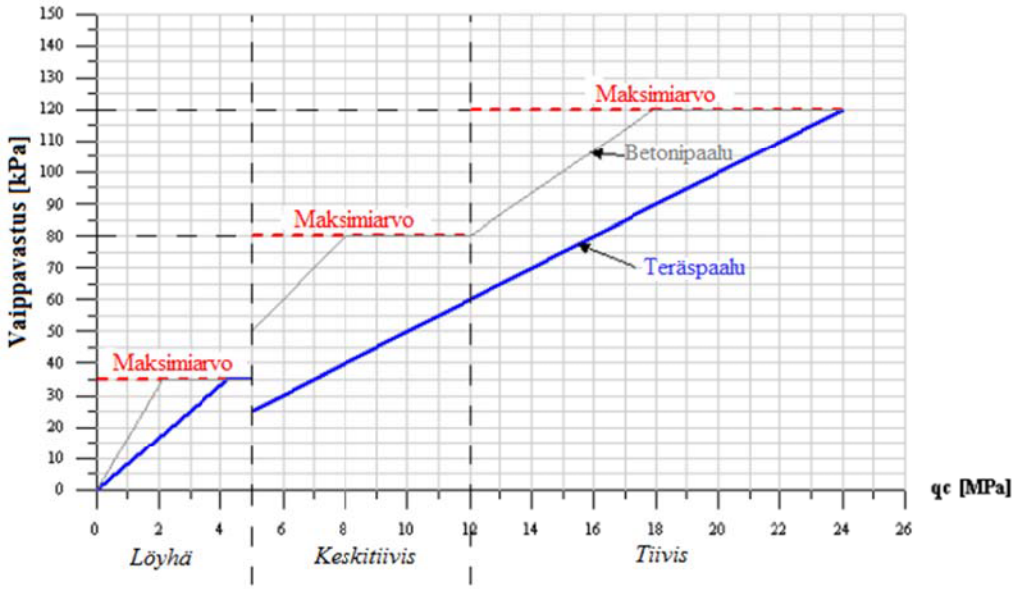
α_i

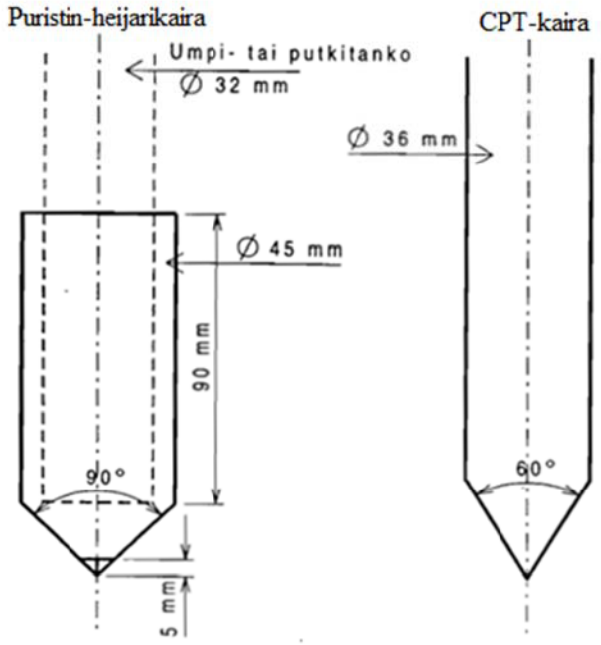
,

Maalaji ja suhteellinen tiiviys	q_c [Mpa]	Korjauskerroin k_c	Maksimiarvo [kPa] q_s
			Lyömällä asennetut paalut
Silttinen hiekka / löyhä hiekka	< 5	0,5	35
Keskitiivis hiekka / sora	5-12	0,5	80
Tiivis hiekka / sora	> 12	0,4	120

Maalaji	q_c (MPa)	Kerroin α	q_s:n maksimiarvo (MPa)
Lieju			
Pehmeä savi	<1	30	0,015
			(0,08)
Kohtalaisen tiivis savi	1-5	40	0,035
Siltti			
Löyhä hiekka	≤5	60	0,035
Tiivis ja jäykkä savi			(0,08)
Tiivis siltti	>5	60	0,035
Kohtalaisen tiivis hiekka			(0,12)
Kohtalaisen tiivis sora	5-12	100	0,08
Tiivis ja hyvin tiivis hiekka			(0,15)
Tiivis ja hyvin tiivis sora	>12	150	0,12

α


Vaippavastus [kPa]
qc [MPa]
Maksimiarvo
Betonipaalu
Maksimiarvo
Teräspaalu
Maksimiarvo
Löyhä
Keskitiivis
Tiivis


Puristin-heijarikaira
Umpi- tai putkitanko
Ø 32 mm
Ø 36 mm
Ø 45 mm
90 mm
90°
5 mm
CPT-kaira
60°

Kestävyys	Merkintä	Sarja *R2*
Kärki	γ_b	1,20
Vaippa (puristus)	γ_s	1,20
Kokonais-/yhdistetty (puristus)	γ_t	1,20
Vedetty vaippa:		
- lyhytaikainen kuormitus	$\gamma_{s,t}$	1,35
- pitkäaikainen kuormitus	$\gamma_{s,t}$	1,50

$$R_{c;d} = R_{b;k}/\gamma_b + R_{s;k}/\gamma_s$$

γ_b
γ_s

3.6.1 Mallipaalumenetelmä (RIL 254-2011)

$R_{c;cal}$

$$R_{c;k} = (R_{b;k} + R_{s;k}) = \frac{R_{b;cal}+R_{s;cal}}{\xi} = \frac{R_{c;cal}}{\xi} = \text{Min}\left\{\frac{(R_{c;cal})_{mean}}{\xi_3}; \frac{(R_{c;cal})_{min}}{\xi_4}\right\}$$

ξ

ξ

ξ_3 ξ_4

ξ kun n =	1	2	3	4	5	7	10
ξ_3	1,85	1,77	1,73	1,69	1,65	1,62	1,60
ξ_4	1,85	1,65	1,60	1,55	1,50	1,45	1,40

ξ_3 ξ_4

3.6.2 Vaihtoehtoinen menetelmä (RIL 254-2011)

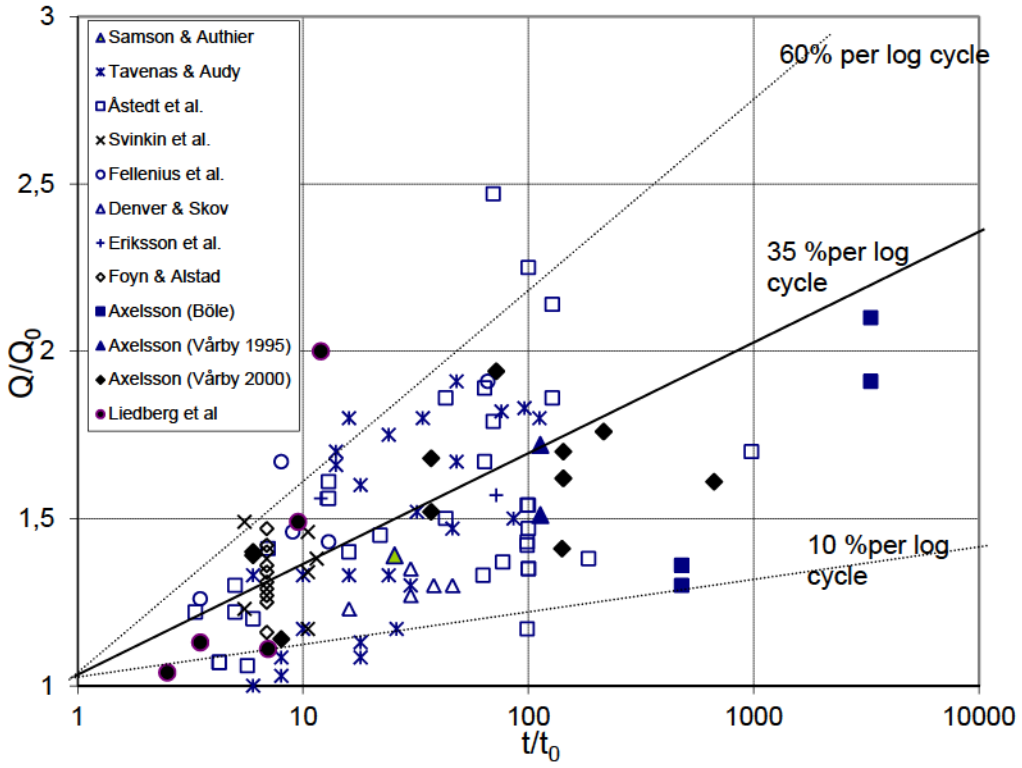
	Mallikerroin
Tuki- ja kitkapaalut	≥ 1,60
Koheesiopaalu	
pitkäaikainen kuormitus	≥ 1,95
lyhytaikainen kuormitus	≥ 1,40

$$R_{c;d} = \frac{R_{b;k}}{\gamma_b * \text{mallikerroin}} + \frac{R_{s;k}}{\gamma_s * \text{mallikerroin}}$$

4 Aikatekijä

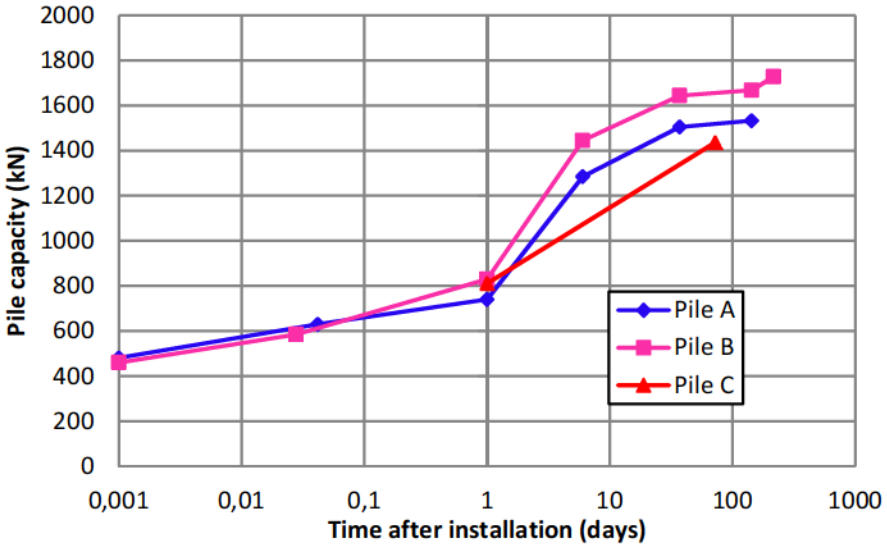
Q_0

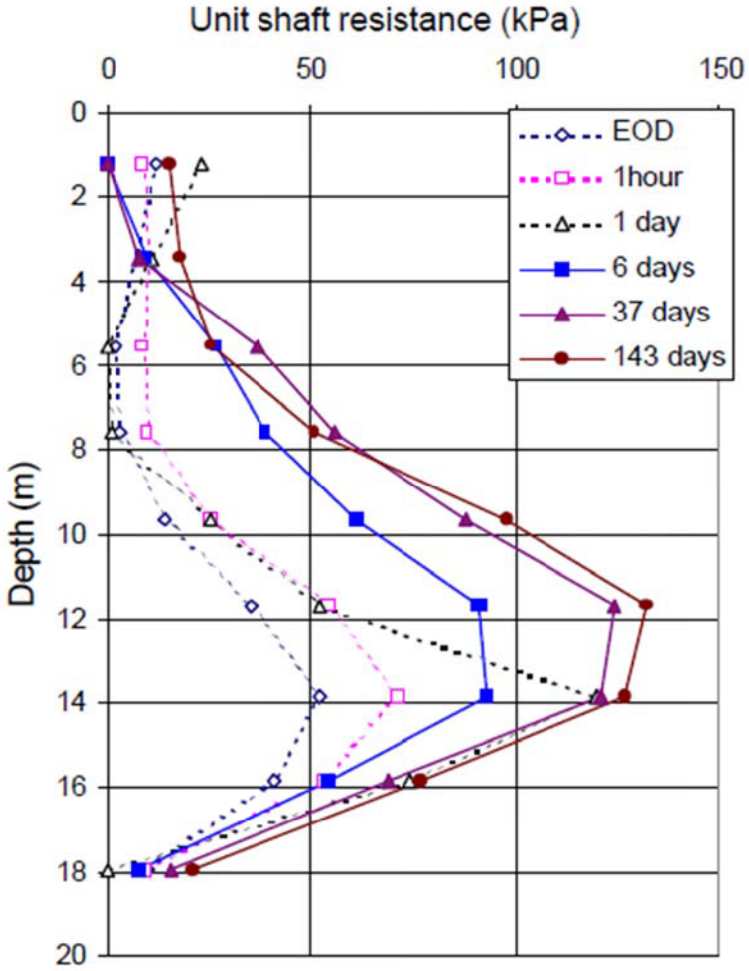
Q_0

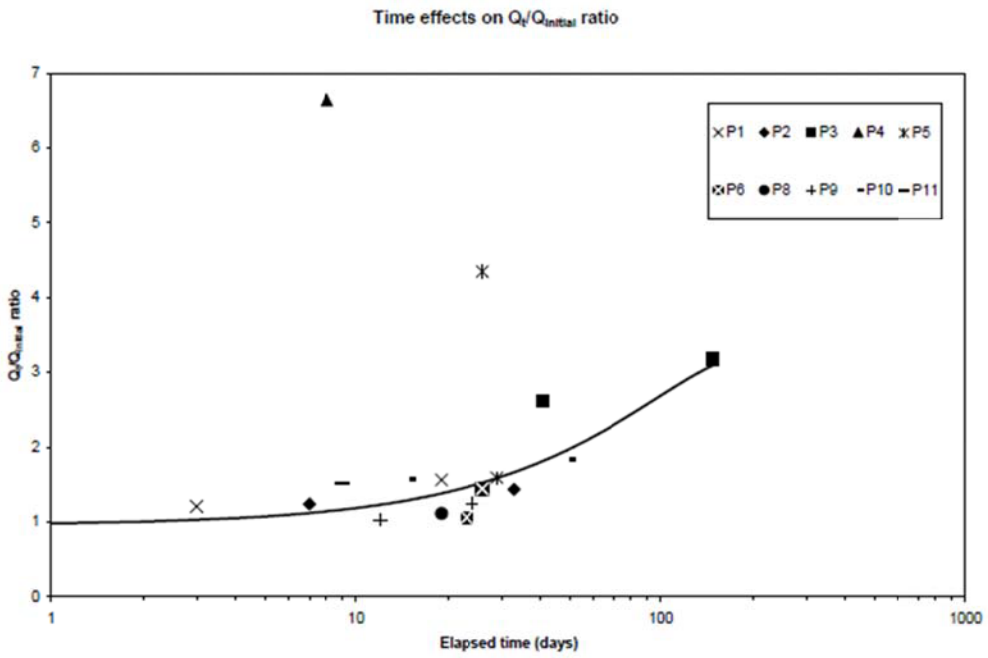


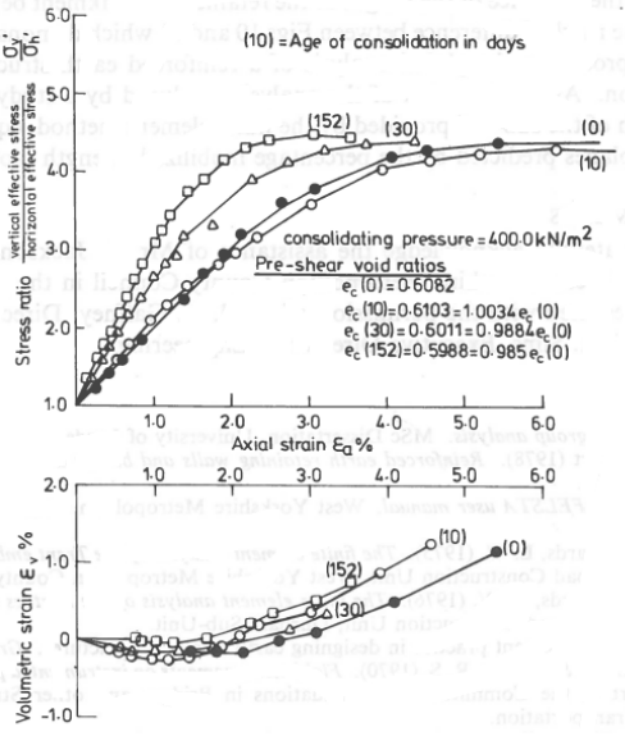
$Q/Q_o = 2 \quad t/t_o = 12$

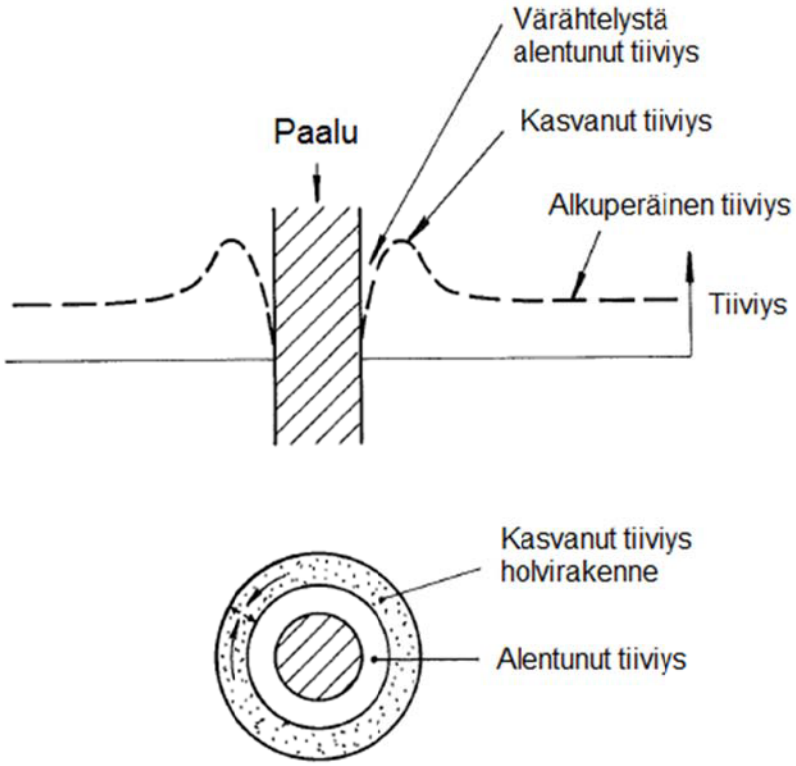
$Q/Q_o = 1{,}7 \quad t/t_o = 979$

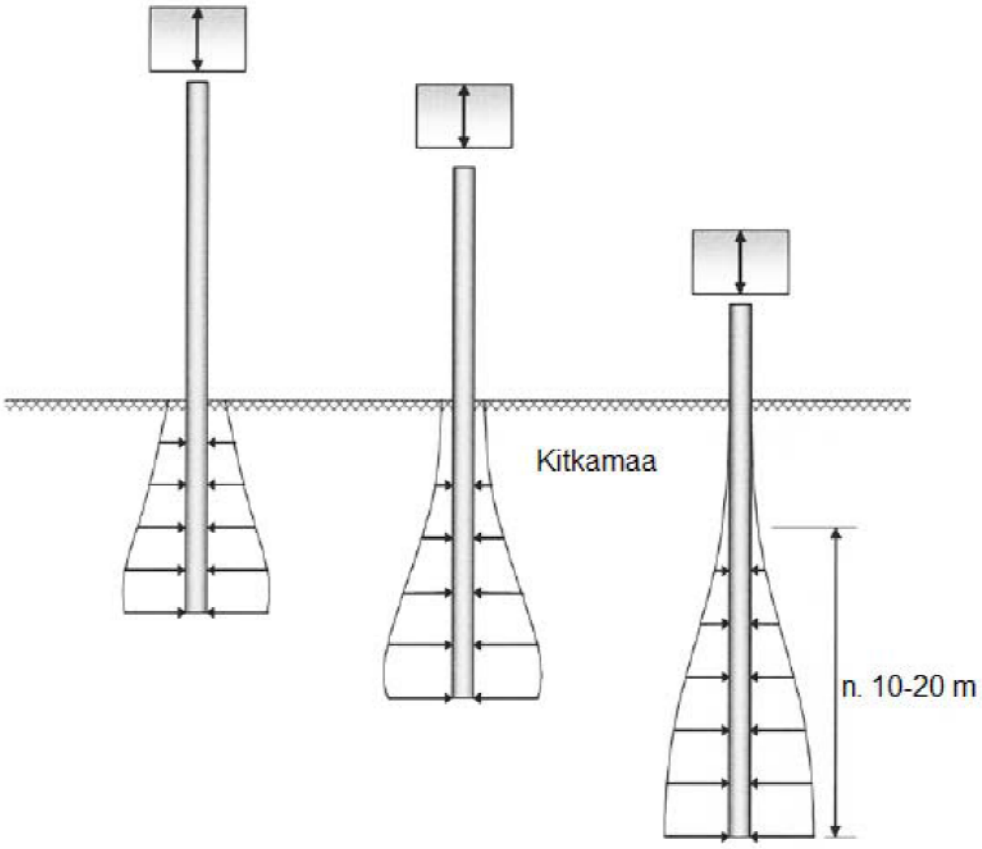

2000
1800
1600
1400
1200
1000
800
600
400
200
0
Pile capacity (kN)
0,001
0,01
0,1
1
10
100
1000
Time after installation (days)
Pile A
Pile B
Pile C


Unit shaft resistance (kPa)
0
50
100
150
0
2
4
6
8
10
12
14
16
18
20
Depth (m)
EOD
1hour
1 day
6 days
37 days
143 days


Time effects on $Q_t/Q_{initial}$ ratio
$Q_t/Q_{initial}$ ratio
Elapsed time (days)
P1
P2
P3
P4
P5
P6
P8
P9
P10
P11
0
1
2
3
4
5
6
7
1
10
100
1000


(10) = Age of consolidation in days
Stress ratio $\frac{\sigma_v'}{\sigma_h'}$ vertical effective stress / horizontal effective stress
6·0
5·0
4·0
3·0
2·0
1·0
(152)
(30)
(0)
(10)
consolidating pressure = 400·0 kN/m²
Pre-shear void ratios
e_c (0) = 0·6082
e_c (10) = 0·6103 = 1·0034 e_c (0)
e_c (30) = 0·6011 = 0·9884 e_c (0)
e_c (152) = 0·5988 = 0·985 e_c (0)
1·0 2·0 3·0 4·0 5·0 6·0
Axial strain ε_a %
Volumetric strain ε_v %
2·0
1·0
0
-1·0
(10)
(0)
(152)
(30)


Värähtelystä
alentunut tiiviys
Paalu
Kasvanut tiiviys
Alkuperäinen tiiviys
Tiiviys
Kasvanut tiiviys
holvirakenne
Alentunut tiiviys


Kitkamaa
n. 10-20 m

$$\tau_f = \sigma'_{rf} \tan\delta_f$$

τ_f
σ'_{rf}
δ_f

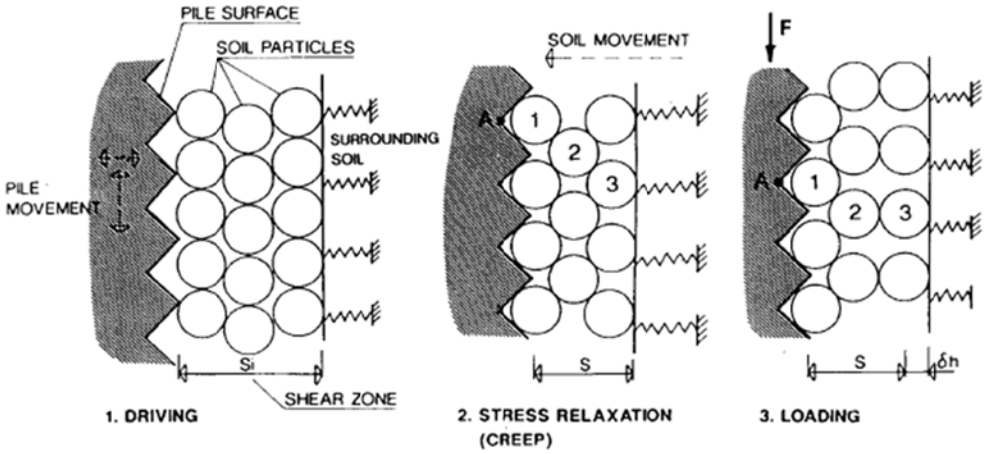
δ_f

δ_{cv} δ_{cv}

$\Delta\sigma'_r$

$$\sigma'_{rf} = \sigma'_{rc} + \Delta\sigma'_r$$

σ'_{rc}
$\Delta\sigma'_r$



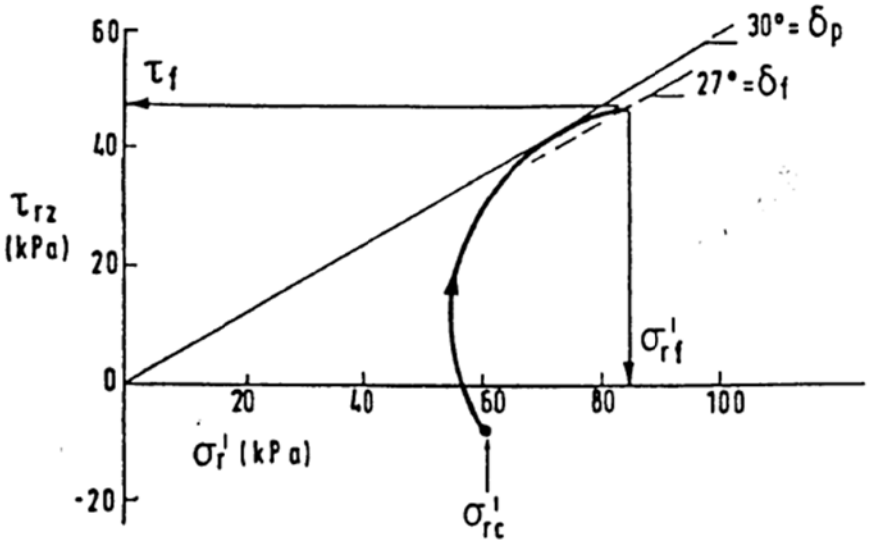
$$\Delta\sigma'_r = \Delta\sigma'_{rd} + \Delta\sigma'_{rp}$$

$\Delta\sigma'_{rd}$

$\Delta\sigma'_{rp}$

σ'_r

σ'_r σ'_{rc}



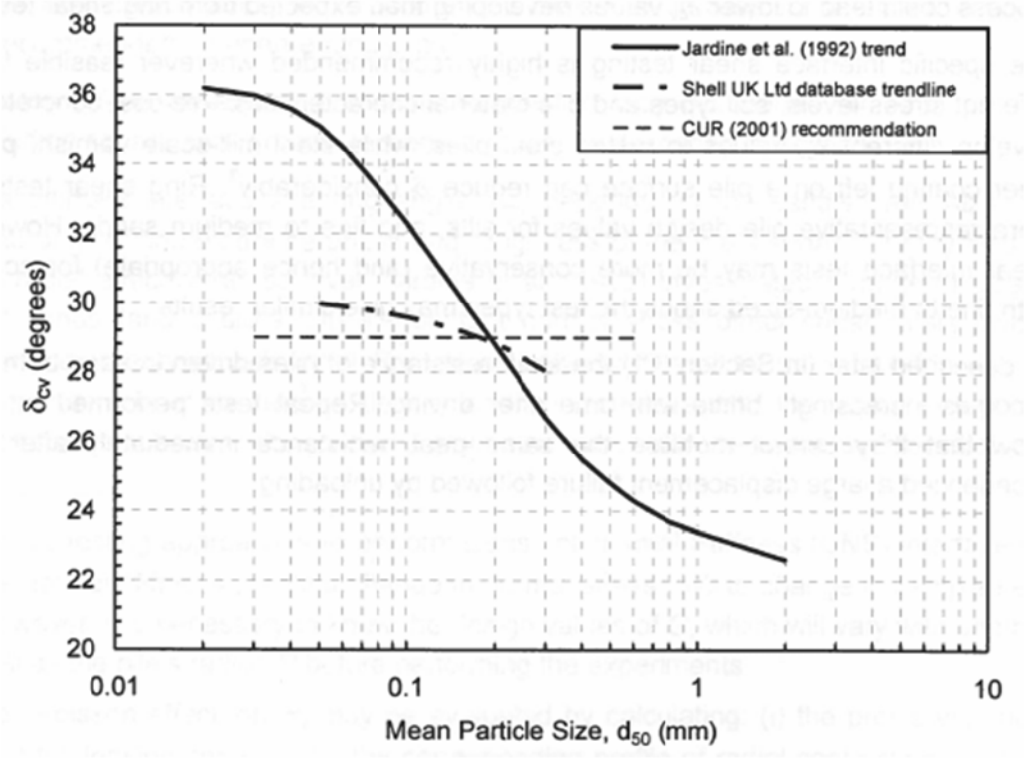
$\Delta\sigma'_{rd}$

$$\Delta\sigma'_{rd} = 2\delta h \frac{G}{R}$$

δ

4.4.1 Maarakeiden koon, muodon ja lujuuden vaikutus

δ_{cv}



4.4.2 Vaippapinnan karkeuden vaikutus

$\cdot d_{50}$ d_{50}

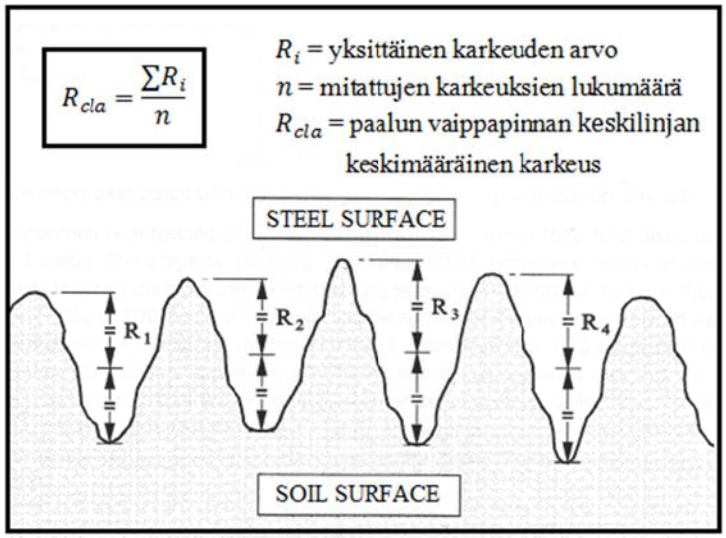
$$\Delta\sigma'_r = \frac{4GR_{cla}}{R}$$

R_{cla}

δ R_{cla} R_{cla}

δ

R_{cla}



4.4.3 ICP-metodi

Laskentamenetelmää on kehitetty yli kaksikymmentä vuotta eri tutkimuksien avulla. Menetelmä on kehitetty instrumentoitujen paalujen koekuormitustulosten pohjalta ja menetelmä on korjattu vastaamaan aikaisempia teräsbetoni- ja teräspaalujen koekuormitustuloksia (Jardine & Chow 1996; Jardine et al. 2005). ICP-metodi on ensisijaisesti suunniteltu teräspaalujen geoteknisen kestävyyden laskentaan, mutta menetelmää voidaan käyttää myös teräsbetonipaalujen geoteknisen kestävyyden laskennassa.

ICP-metodi on mielenkiintoinen menetelmä, koska se ottaa geoteknisen kestävyyden kasvun ajan suhteen huomioon toisin kuin muut laskentatavat, tosin hyvin rajallisesti. Tehokas säteen suuntainen lepojännitys ja dilataatio ovat aikariippuvaisia laskentaparametreja, joiden kasvun perusteella geoteknisen kestävyyden kasvaminen ajan suhteen huomioidaan.

Vaippavastuksen laskeminen

Vaippavastus lasketaan kymmenen päivän kuluttua paalun asennuksesta. Vaippavastuksen laskenta perustuu Coulombin murtokriteeriin samoin kuin kaava 4.1.

$$f_s = \sigma'_{rf} \tan\delta_{cv} \qquad (4.6)$$

missä f_s = vaippavastus murtotilassa
δ_{cv} = paalu vaipan ja maan välisen rajapinnan leikkauskestävyyskulma vakio tilavuudessa

Rajapinnan leikkauskestävyyskulma määritetään kuvan 4.10 kuvaajan perusteella. Termi σ'_{rf} määritetään lähes samalla tavalla kuin kaavassa (4.2). Ainoana erona on, että lepotilassa vaikuttava jännitys lasketaan kymmenen päivän kuluttua paalun asennuksesta ja kuormituksessa muuttunut jännitys lasketaan vain dilataation perusteella.

$$\sigma'_{rf} = \sigma'_{rc} + \Delta\sigma'_{rd} \qquad (4.7)$$

missä σ'_{rc} = tehokas säteen suuntainen jännitys lepotilassa (10 päivän kuluttua asennuksesta)

Dilataatiosta johtuva jännitysmuutos kuormituksessa lasketaan kaavalla (4.4). Kaavassa (4.4) dilataatio δh saa teräspaaluilla arvon 0,02 mm ja teräsbetonipaaluilla arvon 0,03 mm. Kaavassa (4.4) esiintyvä maan leikkausmoduuli, G, määritetään laboratoriokokeiden avulla. Maan leikkausmoduuli voidaan arvioida myös CPT-kairausvastuksen perusteella, Baldi et al. (1989) esittämällä kaavalla

$$G = q_c / \left[A + B \frac{q_c}{\sqrt{P_a \cdot \sigma'_{v0}}} - C\left(\frac{q_c}{\sqrt{P_a \cdot \sigma'_{v0}}}\right)^2 \right] \qquad (4.8)$$

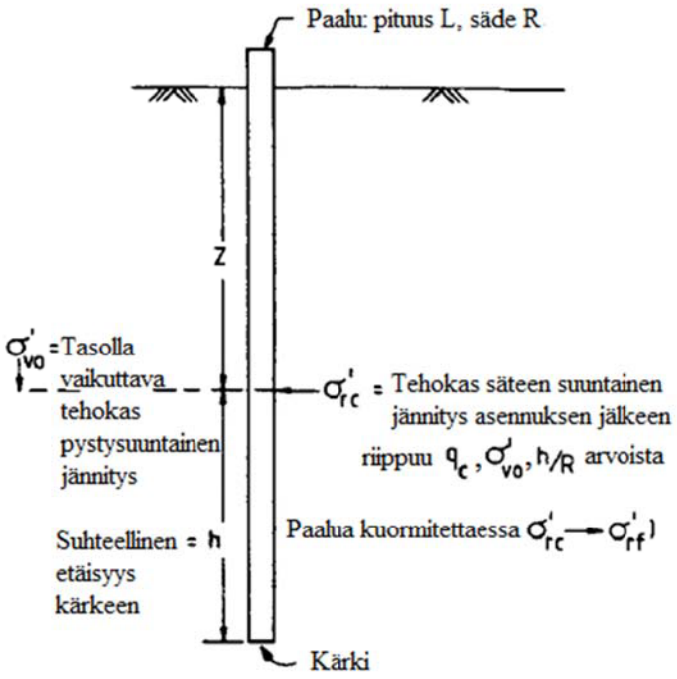
missä A = 0,0204
B = 0,00125
C = 1,216 $\cdot 10^{-6}$
q_c = CPT-kairausvastus maakerroksessa
σ'_{v0} = tehokas pystysuora jännitys
P_a = ilmanpaine 100 kPa

σ'_{rc}

$$\sigma'_{rc} = 0{,}029 q_c \left(\frac{\sigma'_{v0}}{P_a}\right)^{0{,}13} \left(\frac{h}{R}\right)^{-0{,}38}$$

h

R_{ekv} $\sqrt{\pi}$



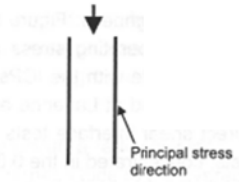
$R^* =$

$\sqrt{R^2_u - R^2_s}$ R_u R_s

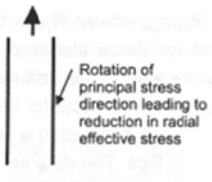
Kärkivastuksen laskeminen

$$q_s = q_c \left(1 - 0{,}5 \log {}^{D}/_{D_{CPT}}\right)$$

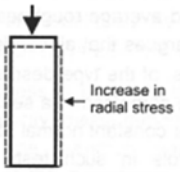
D_{CPT}



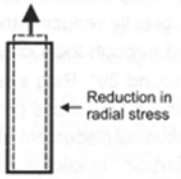
Stresses during driving
and compression loading



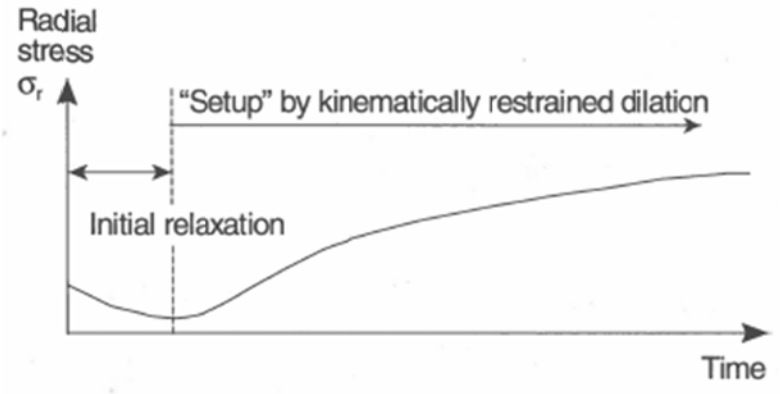
Stresses during
tension loading



Shortening and radial
expansion during driving
and compression loading



Elongation and
contraction during
tension loading


Radial
stress
σ_r
"Setup" by kinematically restrained dilation
Initial relaxation
Time

4.6.1 Skov & Denver (1998)

$$\frac{Q}{Q_0} = 1 + A \log\left(\frac{t}{t_0}\right)$$

t
t_0
Q_0
Q
A

$$A = 0{,}005 \left(\frac{L}{D}\right) \exp(0{,}6 \tan\phi)$$

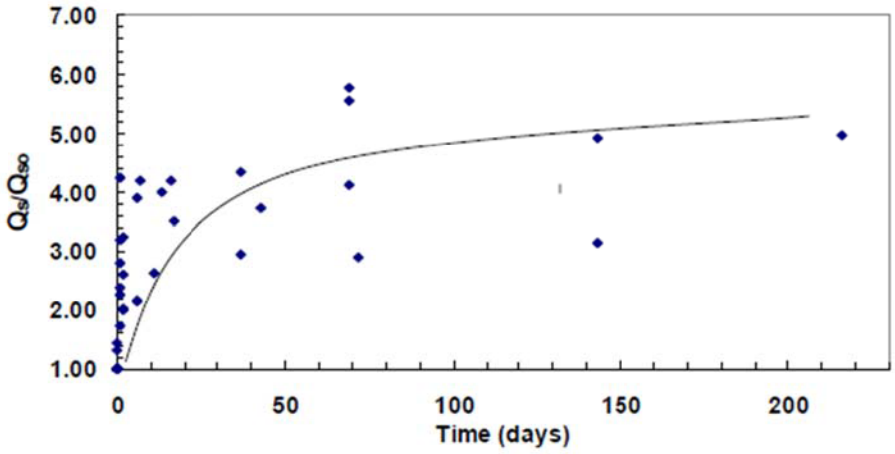
L
D
ϕ

4.6.2 Svinkin (1996)

$$Q_t = (1{,}025 - 1{,}4)Q_0\, t^{0{,}1}$$

4.6.3 Alawned et al. (2009)

°

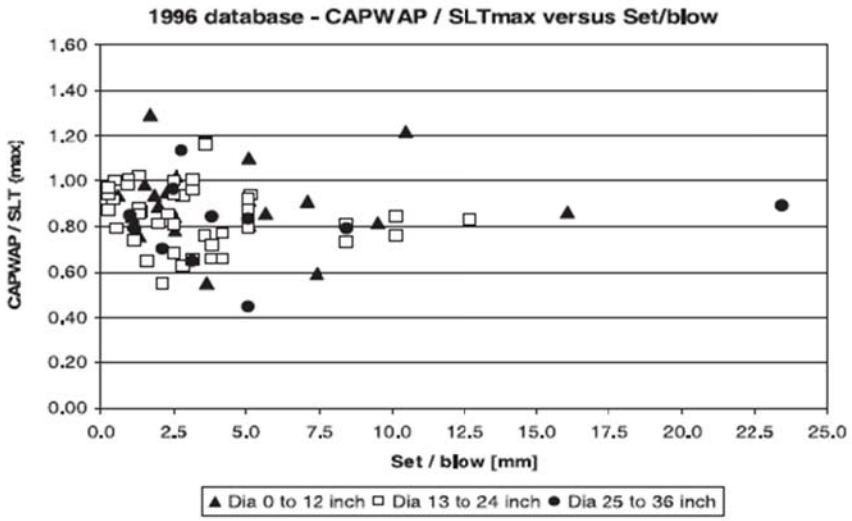


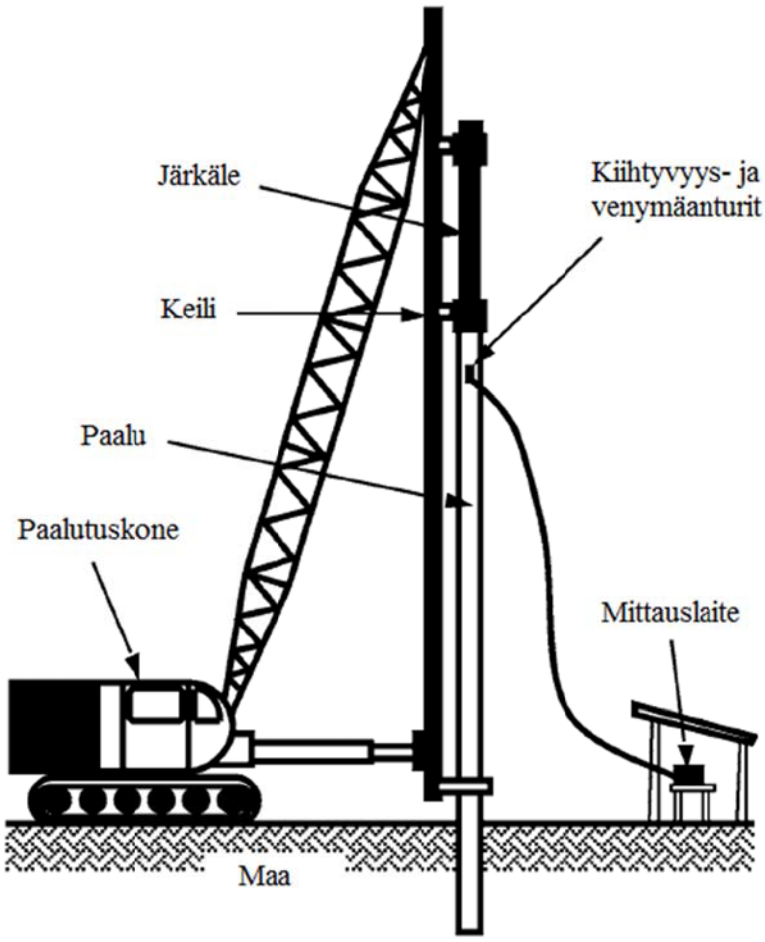
$$\frac{Q_t}{Q_0} = 1 + 0{,}005\left(\frac{L}{D}\right)\exp(0{,}6\tan\phi)\log(\frac{t}{t_0})$$

$$\frac{Q_t}{Q_0} = 1 + 0{,}007\left(\frac{L}{D}\right)\exp(0{,}14D_r)\log(\frac{t}{t_0})$$

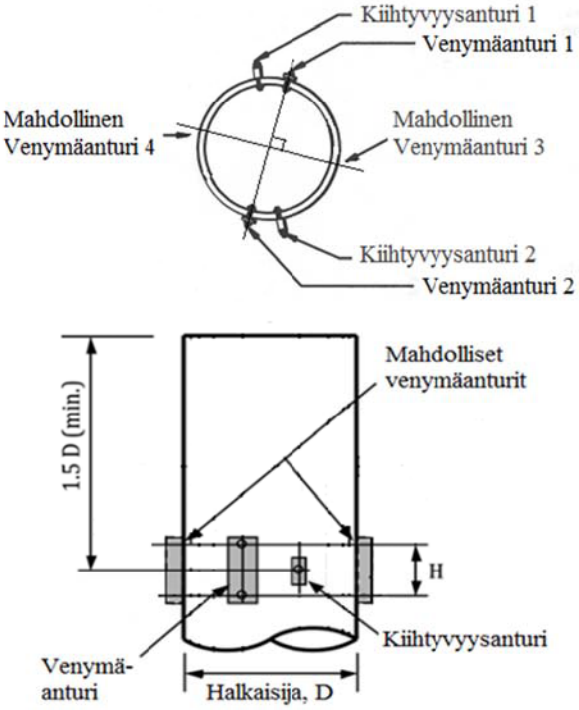
D_r

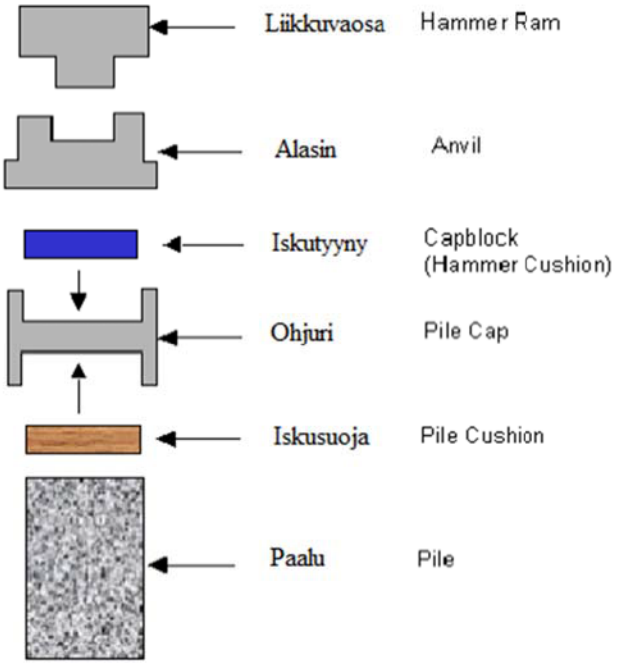
5 Dynaaminen koekuormitus ja signaalin-mallinnus





5.2.1 Laitteisto


Kiihtyvyysanturi 1
Venymäanturi 1
Mahdollinen
Venymäanturi 4
Mahdollinen
Venymäanturi 3
Kiihtyvyysanturi 2
Venymäanturi 2
1.5 D (min.)
Mahdolliset
venymäanturit
H
Kiihtyvyysanturi
Venymä-
anturi
Halkaisija, D



5.2.2 Iskuaaltoteoria

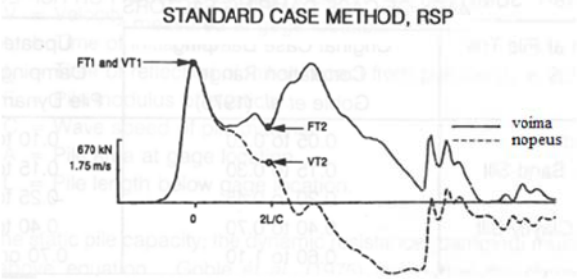
$$RTL = \frac{F(t_1)+F(t_2)}{2} + \left[\frac{V(t_1)-V(t_2)}{2}\right]\frac{EA}{c}$$

RTL
F
t_1
t_2 $t_1 + 2L/C)$
V
E
A_{pl}
c

$$RSP = RTL - J_c\left[V(t_1)\frac{EA}{c} + F(t_1) - RTL\right]$$

RSP
J_c

t_1

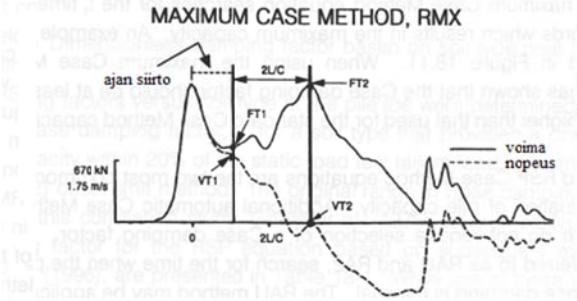


Kokonaisvastus

RTL = 1/2 (FT1 + FT2) + 1/2 (VT1 - VT2) (EA/C)
= 1/2 (1486 + 819) + 1/2 (3.93 -1.07) 381
= 1153 + 545 = 1698 kN.

Staattinen vastus

RSP = RTL - J[VT1 (EA/C) + FT1 - RTL]
= 1698 - 0.4 [3.93 (381) + 1486 - 1698]
= 1698 - 514 = 1184 kN.



Kokonaisvastus

RTL = 1/2 (FT1 + FT2) + 1/2 (VT1 - VT2) (EA/C)
= 1/2 (819 + 1486) + 1/2 (1.92 - 0.0) 381
= 1153 + 366 = 1519 kN.

Staattinen vastus

RMX = RTL - J[VT1 (EA/C) + FT1 - RTL]
= 1519 - 0.4 [1.92 (381) + 819 - 1519]
= 1519 - 13 = 1506 kN.

$$K = \frac{[F(t_3) - V(t_3)\left(\frac{EA}{c}\right) - F(t_1) + V(t_1)\left(\frac{EA}{c}\right)]}{2}$$

$$RSU = RTL + K - J_c\left[V(t_1)\frac{EA}{c} + F(t_1) - RTL - K\right]$$

K

$$2L/C$$

5.2.3 Dynaamisen koekuormituksen käyttösovellukset

Geotekninen luokka, ks. kohta 2.3	Seuraamusluokka, ks. SFS-EN 1990		
	CC1	CC2	CC3
GL1*	PTL1...(PTL3)	PTL2...(PTL3)	PTL2...(PTL3)
GL2	PTL1...(PTL3)	PTL2...(PTL3)	PTL3
GL3	PTL2...(PTL3)	PTL2...(PTL3)	PTL3

Paalun materiaali	Suurin sallittu puristusrasituksen aikaansaava keskeinen lyöntivoima asennettaessa $F_{c;lyönti}$	Suurin kestävyyden ominaisarvo $R_{k;geo;max}$
Teräspaalu	$\leq 0{,}9 \cdot f_{yk} \cdot A_s$	PTL3: $R_{k;geo;max} \leq F_{c;lyönti}$ PTL2: $R_{k;geo;max} \leq 0{,}8 \cdot F_{c;lyönti}$ PTL1: $R_{k;geo;max} \leq 0{,}6 \cdot F_{c;lyönti}$
Teräsbetonipaalu	$\leq 0{,}8 \cdot f_{ck} \cdot A_c$ [a]	PTL3: $R_{k;geo;max} \leq F_{c;lyönti}$ PTL2: $R_{k;geo;max} \leq 0{,}8 \cdot F_{c;lyönti}$ PTL1: $R_{k;geo;max} \leq 0{,}6 \cdot F_{c;lyönti}$
Puupaalu	$\leq 0{,}8 \cdot f_{c,0,k} \cdot A_{min}$	PTL3: Ei käytetä PTL2: $R_{k;geo;max} \leq 0{,}8 \cdot F_{c;lyönti}$ PTL1: $R_{k;geo;max} \leq 0{,}6 \cdot F_{c;lyönti}$

$F_{c;lyönti}$
$R_{k;geo;max} =$
$f_{yk} =$
$f_{ck} =$
$f_{c,0,k} =$

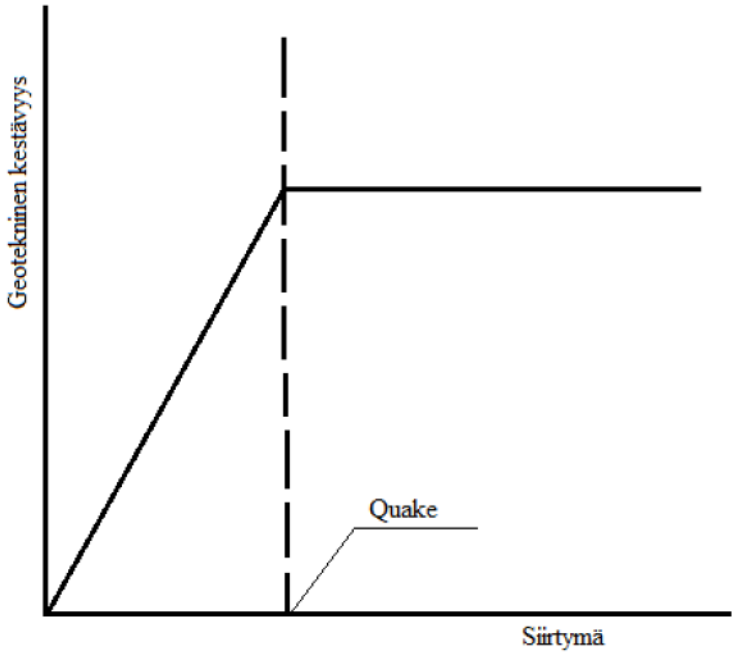
A_s
A_c
A_{min}

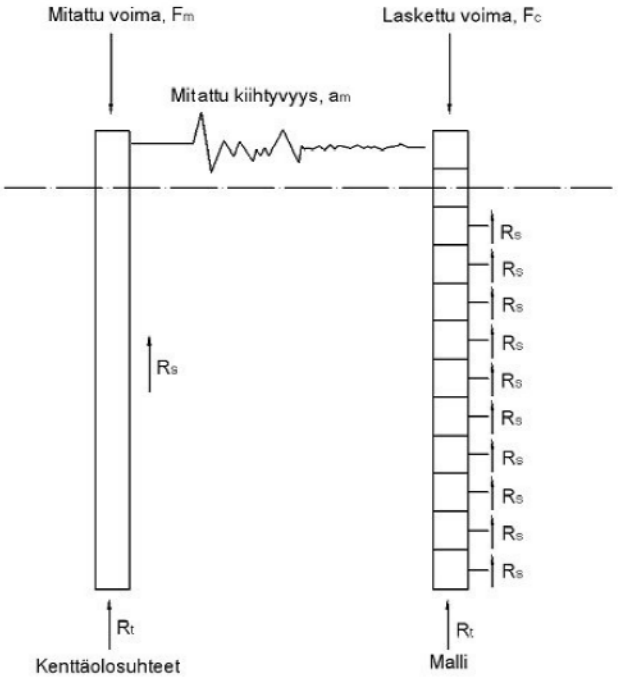
f_{yk}

$F_{t;lyönti} \leq 0{,}9 \cdot f_{yk} \cdot A_s$

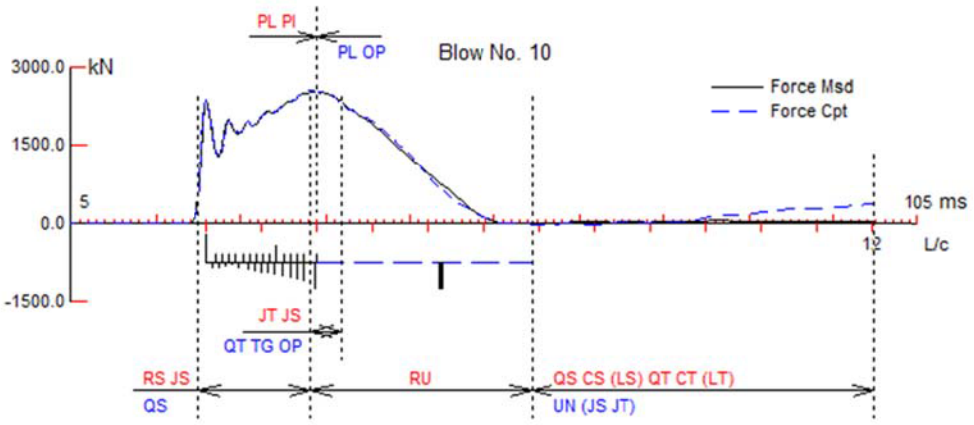
$F_{t;lyönti}$

J_c
J_s.

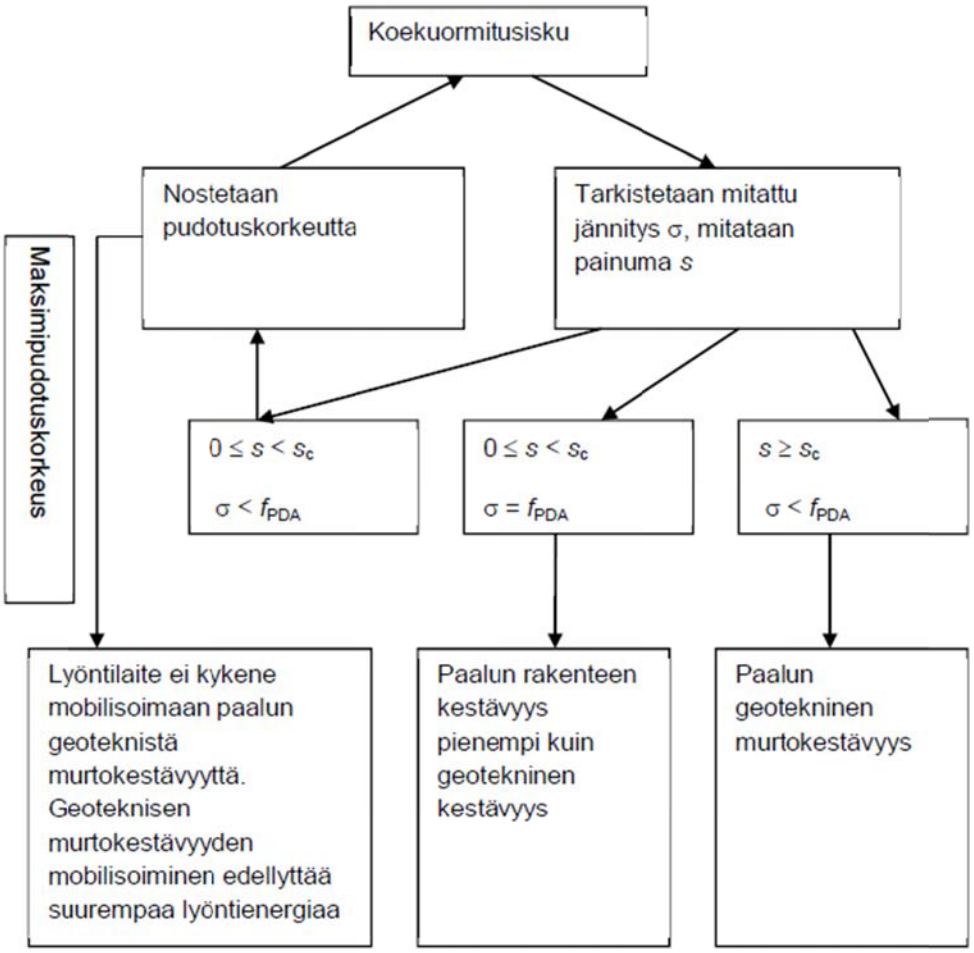




1. Mittaa voima ja kiihtyvyys F_m, a_m
2. Laske $F_c = F_c(a_m, R_s, R_t)$
3. Vertaa F_m ⊂ F_c
4. Korjaa mallia R_s, R_t
5. Iteroi (palaa kohtaan 2)



INCREASE (DECREASE) the RED variables ABOVE line to INCREASE (DECREASE) computed Force/Wave
DECREASE (INCREASE) the BLUE variables BELOW line to INCREASE (DECREASE) computed Force/Wave


Koekuormitusisku
Nostetaan pudotuskorkeutta
Tarkistetaan mitattu jännitys σ, mitataan painuma s
Maksimipudotuskorkeus
0 ≤ s < sc
σ < fPDA
0 ≤ s < sc
σ = fPDA
s ≥ sc
σ < fPDA
Lyöntilaite ei kykene mobilisoimaan paalun geoteknistä murtokestävyyttä. Geoteknisen murtokestävyyden mobilisoiminen edellyttää suurempaa lyöntienergiaa
Paalun rakenteen kestävyys pienempi kuin geotekninen kestävyys
Paalun geotekninen murtokestävyys

$s_c \geq$

$$R_{c;d} = R_{c;k}/\gamma_t$$

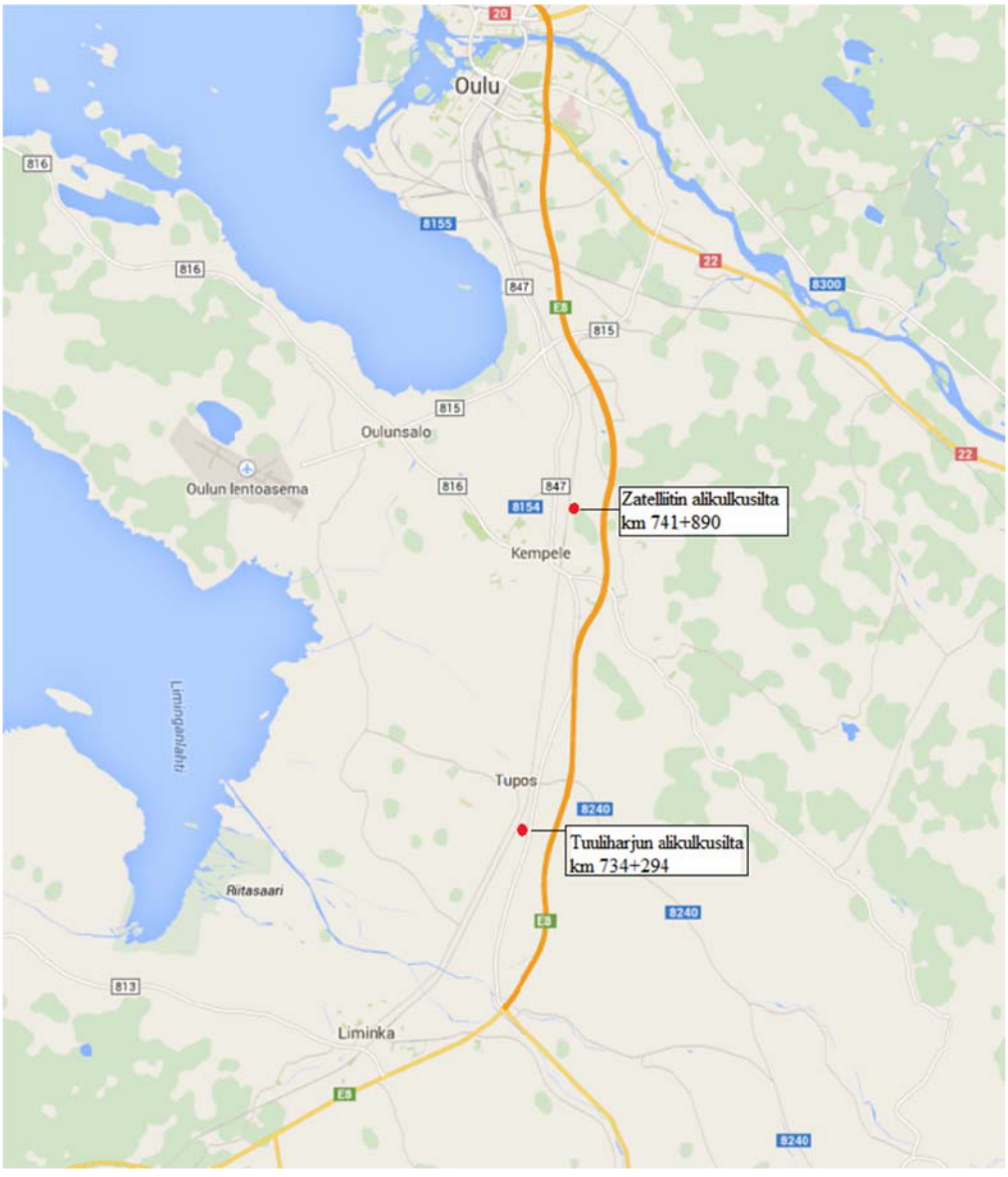
$$R_{c;k} = \text{Min}\left\{\frac{(R_{c;m})_{mean}}{\xi_5}; \frac{(R_{c;m})_{min}}{\xi_6}\right\}$$

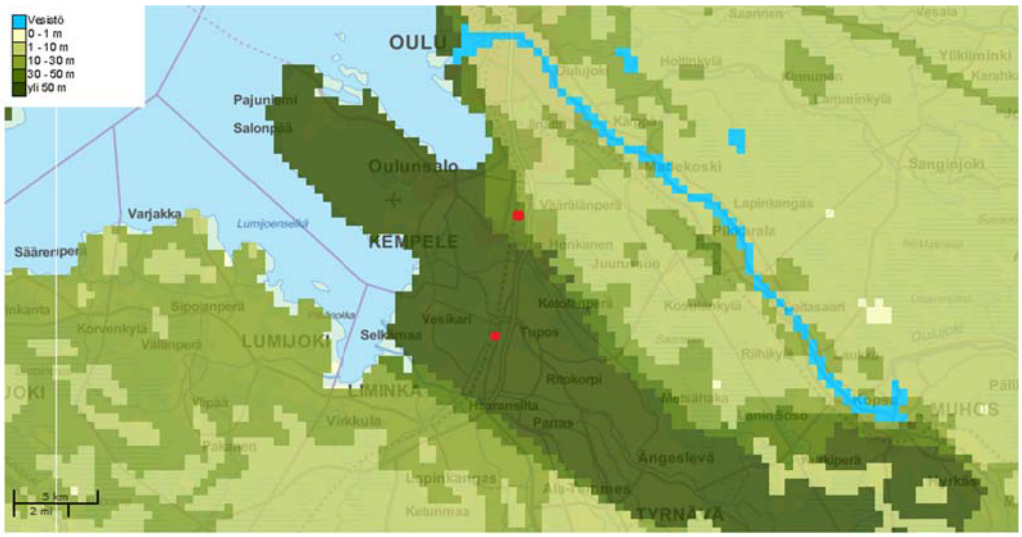
$R_{c;k}$
$R_{c;m}$ =
ξ_5 = $R_{c;m}$
ξ_6 = $R_{c;m}$

*n**	2–4/1–4 %	5–9/5–39 %	10–14/40–64 %	15–19/65–89 %	≥ 20/90–100 %
ξ_5	1,60	1,50	1,45	1,42	1,40
ξ_6	1,50	1,35	1,30	1,25	1,25

ξ_5 ξ_6

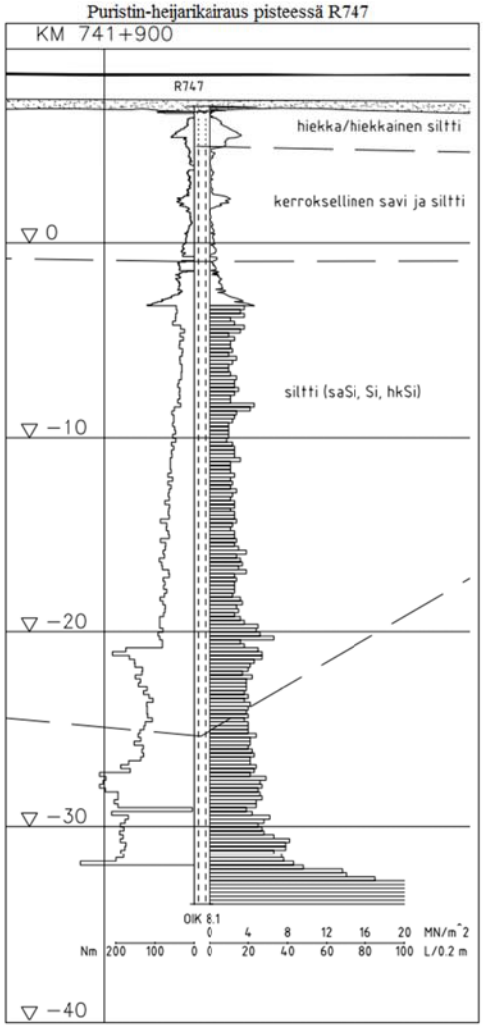
6 Koekohteiden esittely



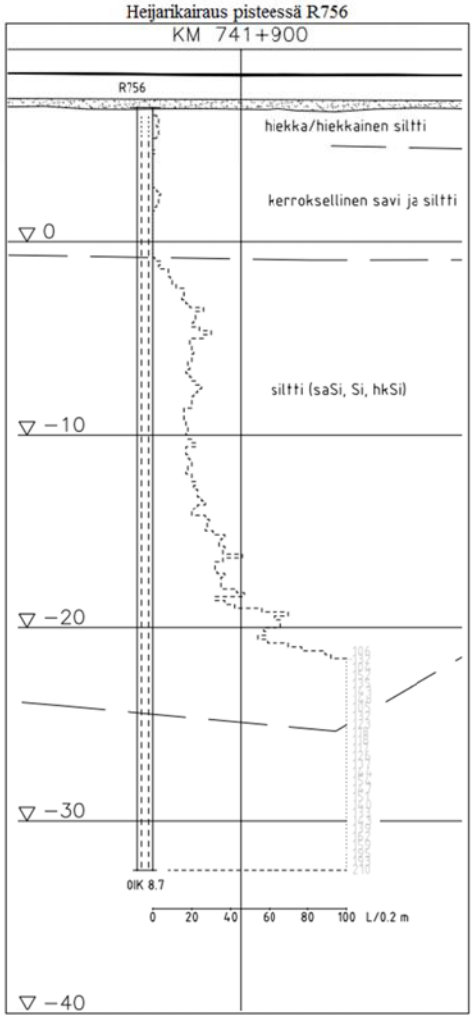

Vesistö
0 - 1 m
1 - 10 m
10 - 30 m
30 - 50 m
yli 50 m
OULU
Pajuniemi
Salonpää
Oulunsalo
Varjakka
Lumijoenselkä
KEMPELE
Säärenperä
Sipoianperä
Korvenkylä
Vähänperä
LUMIJOKI
Selkämaa
Vesikari
Tupos
Ketolanperä
Ritokorpi
LIMINKA
Virkkula
Parras
Ängeslevä
TYRNÄVÄ
Kelunmaa
Sanginjoki
Lapinkangas
Yliliminki
5 km
2 mi

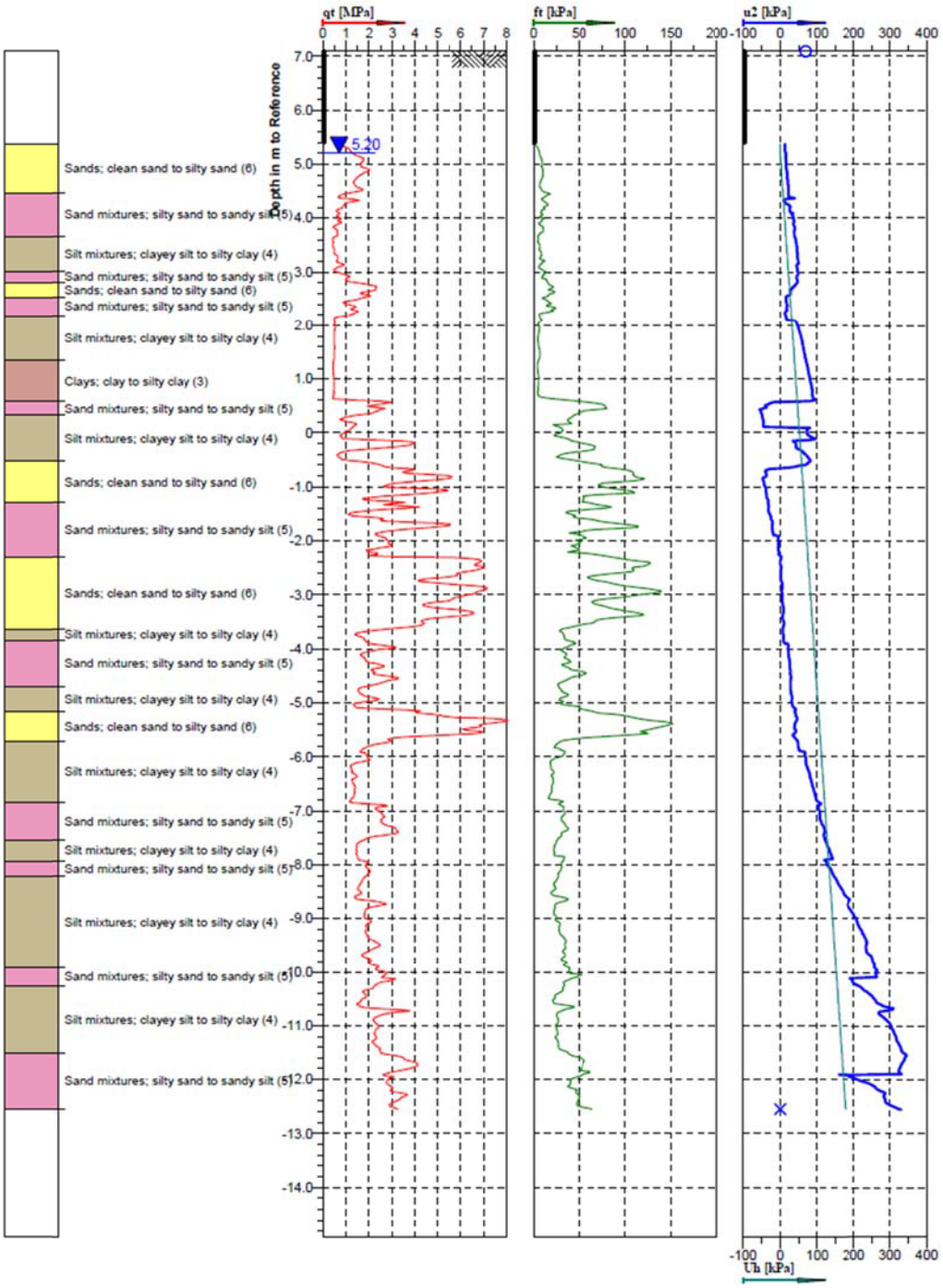
6.2.1 Pohjasuhteet

Puristin-heijarikairaus pisteessä R747



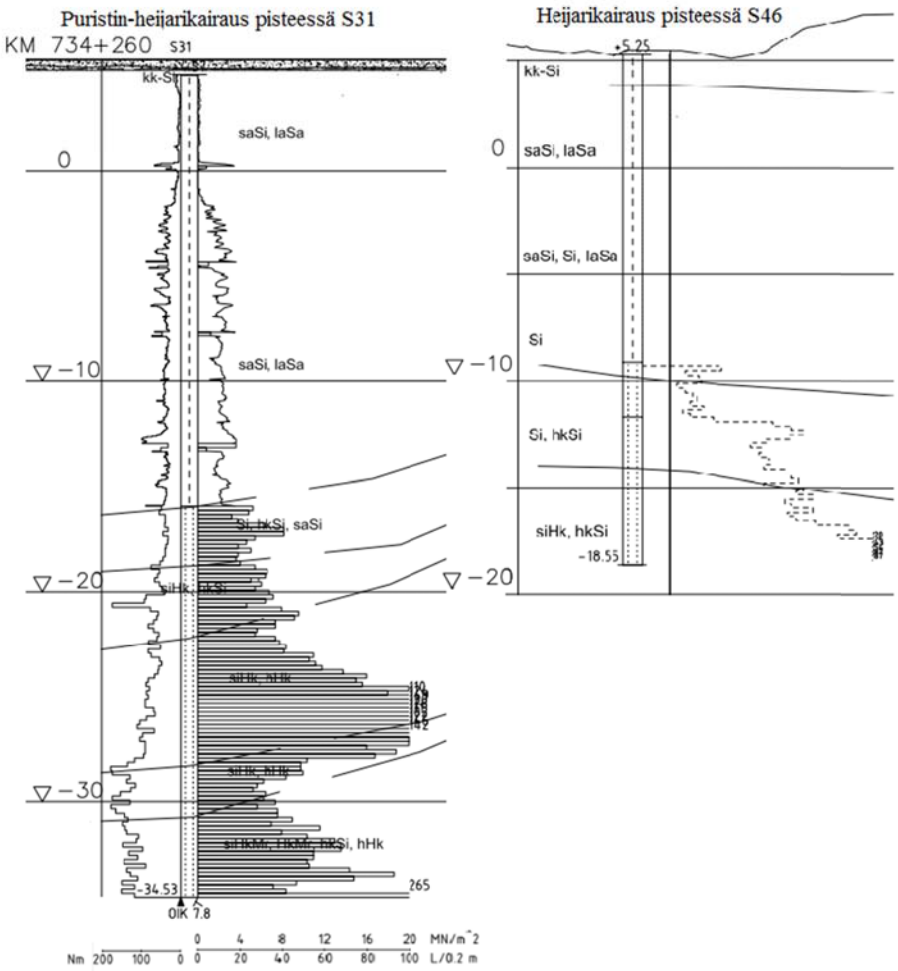
Heijarikairaus pisteessä R756



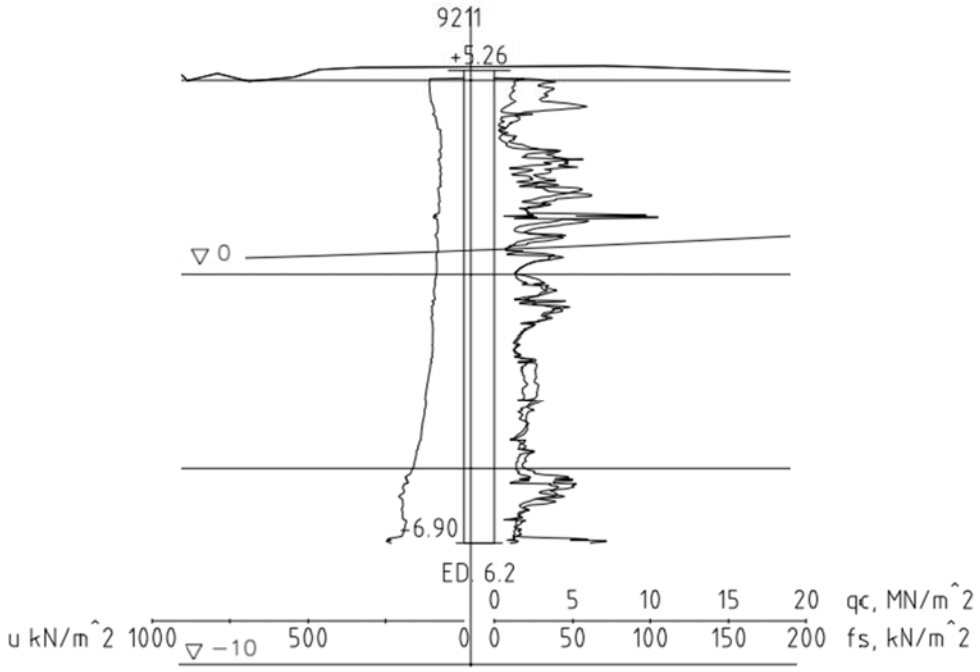

qt [MPa]
fs [kPa]
u2 [kPa]
Depth in m to Reference
5.40
Sands; clean sand to silty sand (6)
Sand mixtures; silty sand to sandy silt (5)
Silt mixtures; clayey silt to silty clay (4)
Clays; clay to silty clay (3)
Uh [kPa]


Seinäjoki
Oulu
TU-B2
TU-B1
TU-T3
TU-T2
TU-T1

6.3.1 Pohjasuhteet


Puristin-heijarikairaus pisteessä S31
KM 734+260 S31
kk-Si
saSi, laSa
0
saSi, laSa
▽ −10
Si, hkSi, saSi
▽ −20
siHk, hkSi
siHk, hHk
▽ −30
siHkMg, HkMg, hkSi, hHk
-34.53
265
OIK 7.8
0 4 8 12 16 20 MN/m^2
Nm 200 100 0 0 20 40 60 80 100 L/0.2 m
Heijarikairaus pisteessä S46
+5.25
kk-Si
0
saSi, laSa
saSi, Si, laSa
Si
▽ −10
Si, hkSi
siHk, hkSi
-18.55
▽ −20

CPTU-kairaus pisteessä 9211



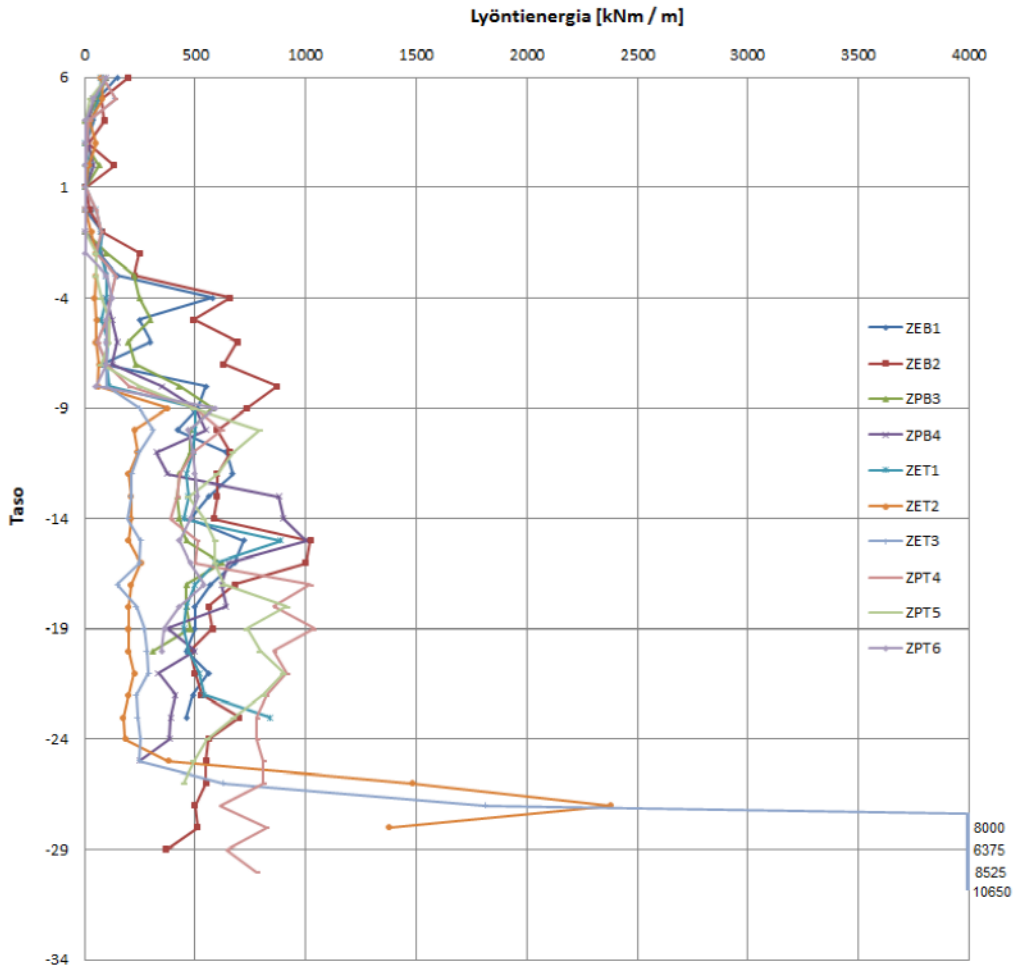
Paalutyyppi	Tunnut	Pituus [m]	Taso
Teräsputkipaalu D323,9*10 mm S440J2H	ZET1	16+16	-23
Teräsputkipaalu D323,9*10 mm S440J2H	ZET2	16+4+16	-27
Teräsputkipaalu D323,9*10 mm S440J2H	ZET3	16+8+16	-30
Teräsputkipaalu D323,9*10 mm S440J2H	ZPT4	16+7+16	-30
Teräsputkipaalu D323,9*10 mm S440J2H	ZPT5	16+3+16	-26
Teräsputkipaalu D323,9*10 mm S440J2H	ZPT6	16+13	-20
Teräsbetonipaalu 300b	ZEB1	15+3+14	-23
Teräsbetonipaalu 300b	ZEB2	15+7+15	-28
Teräsbetonipaalu 300b	ZPB3	15+14	-20
Teräsbetonipaalu 300b	ZPB4	15+4+15	-25
Teräsputkipaalu D323,9*10 mm S440J2H	TU-T1	16+16	-21
Teräsputkipaalu D323,9*10 mm S440J2H	TU-T2	16+3+14	-26
Teräsputkipaalu D323,9*10 mm S440J2H	TU-T3	16+6+12	-31
Teräsbetonipaalu 300b	TU-B1	15+12	-20
Teräsbetonipaalu 300b	TU-B2	15+10+7	-25

Paalu	Mittaus 1. (t=0)	Mittaus 2. (t≈24 h)	Δ [h]	Mittaus 3. (t=14 vrk)	Δ [h]	Mittaus 4. (t=28 vrk)	Δ [h]
ZET1	3.3.2015 klo 11:30	4.3. klo 16:45	29	18.3. klo 12:00	360	31.3. klo 15:15	675
ZET2	3.3. klo 9:15	4.3. klo 16:30	31	18.3. klo 12:30	363	31.3. klo 16:30	679
ZET3	3.3. klo 10:45	4.3. klo 16:15	30	18.3. klo 12:45	363	31.3. klo 17:15	680
ZPT4	2.3. klo 12:00	3.3. klo 12:45	25	18.3. klo 10:30	383	31.3. klo 14:45	699
ZPT5	2.3. klo 13:45	3.3. klo 12:30	23	18.3. klo 10:15	381	31.3. klo 14:15	697
ZPT6	2.3. klo 15:15	3.3. klo 12:15	21	18.3. klo 9:45	379	31.3. klo 13:45	695
ZEB1	3.3. klo 16:45	4.3. klo 16:00	23	18.3. klo 8:30	352		
ZEB2	3.3. klo 16:15	4.3. klo 16:00	24	18.3. klo 8:15	352		
ZPB3	2.3. klo 17:30	3.3. klo 14:15	21	18.3. klo 9:00	376		
ZPB4	2.3. klo 16:45	3.3. klo 14:45	22	18.3. klo 8:45	376		
TU-T1	4.3. klo 9:30	5.3. klo 11:00	26	18.3. klo 14:30	342	31.3. klo 9:00	648
TU-T2	4.3. klo 10:45	5.3. klo 11:00	24	18.3. klo 14:45	340	31.3. klo 9:45	647
TU-T3	4.3. klo 13:00	5.3. klo 10:45	22	18.3. klo 15:00	338	31.3. klo 9:15	644
TU-B1	4.3. klo 14:30	5.3. klo 10:30	20	18.3. klo 15:15	337		
TU-B2	4.3. klo 15:00	5.3. klo 10:15	19	18.3. klo 15:30	336		

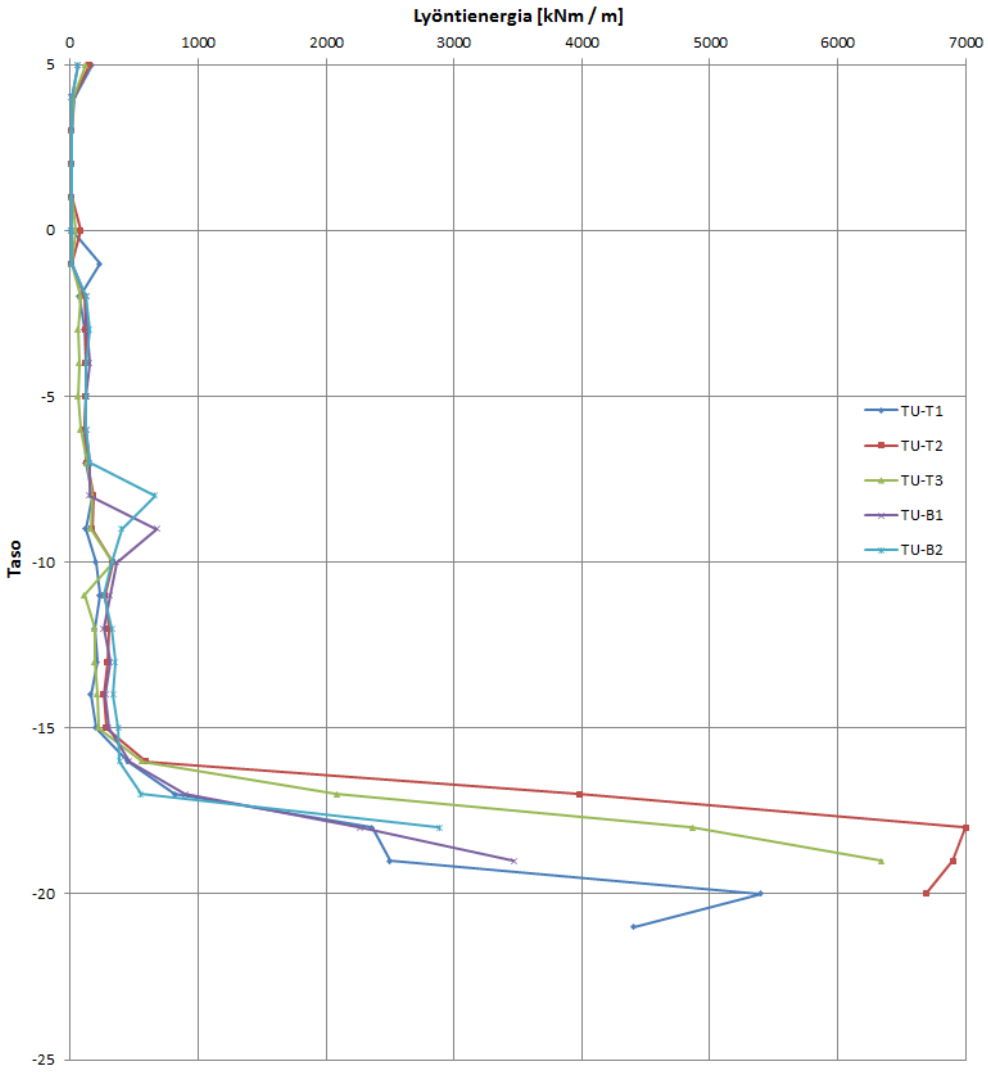
$R_{k;geo;max}$

®


ZE13


Lyöntienergia [kNm / m]
0
500
1000
1500
2000
2500
3000
3500
4000
6
1
-4
-9
-14
-19
-24
-29
-34
Taso
ZEB1
ZEB2
ZPB3
ZPB4
ZET1
ZET2
ZET3
ZPT4
ZPT5
ZPT6
8000
6375
8525
10650

Paalutyyppi	Tunnut	Pituus [m]	Taso
Teräsputkipaalu D323,9*10 mm S440J2H	TU-T1	16+12	-21
Teräsputkipaalu D323,9*10 mm S440J2H	TU-T2	16+3+9	-20
Teräsputkipaalu D323,9*10 mm S440J2H	TU-T3	16+6+4	-19
Teräsbetonipaalu 300b	TU-B1	15+12	-20
Teräsbetonipaalu 300b	TU-B2	15+10	-18



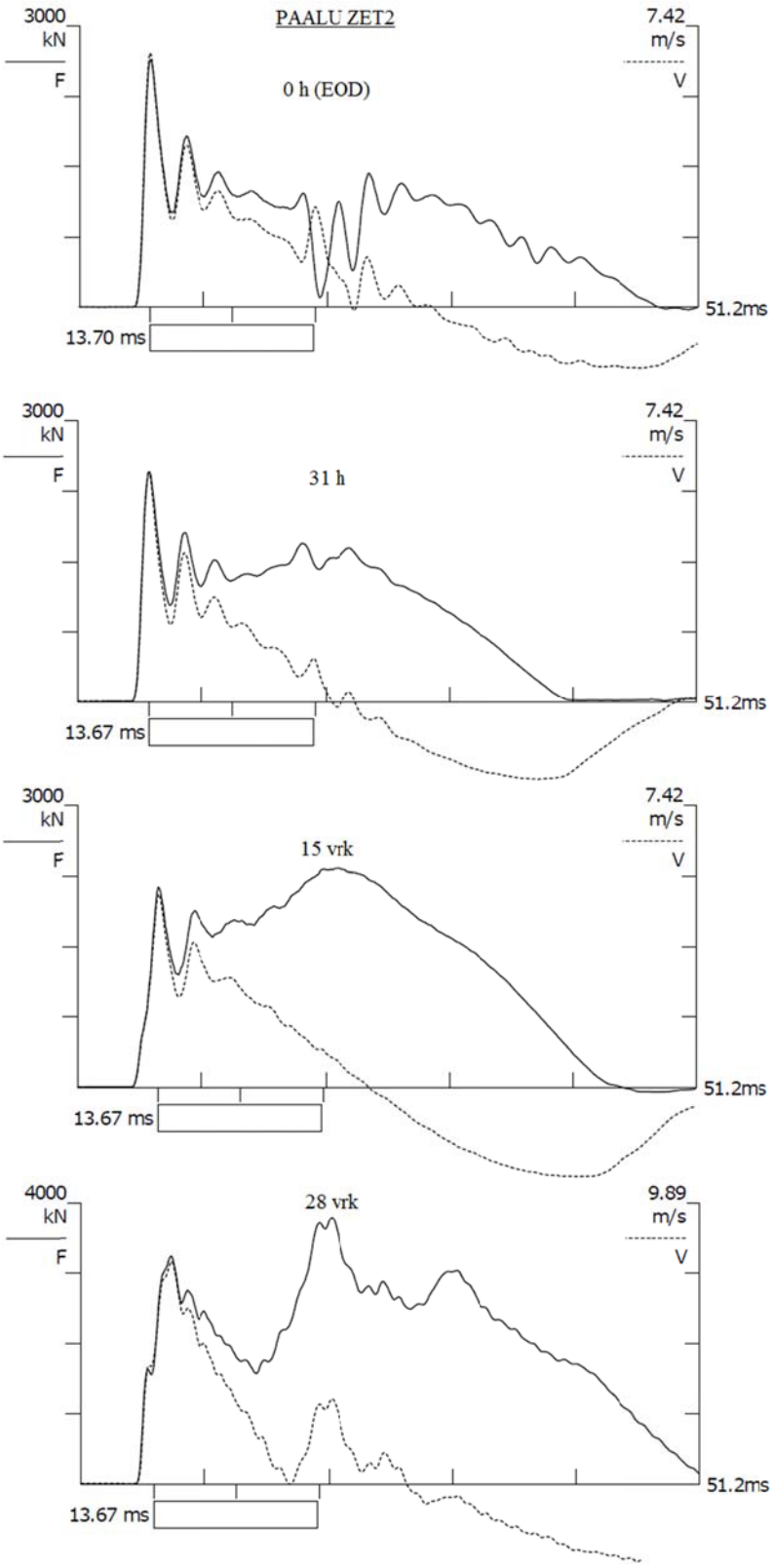
Kuva 6.13. Tuuliharjun koepaalujen lyöntienergia metriä kohden syvyyden funktiona.

Kuvasta 6.13 on selvästi havaittavissa, kuinka tasolla -17 alkaa tiiviimpi kerros lyöntienergian perusteella. Samankaltaista käyttäytymistä ei voida havaita puristinheijarikairauksesta pisteessä S31, joka on esitetty kuvassa 6.7. Tuuliharjussa suurin lyöntienergia metriä kohden oli paalulla TU-T3, jonka viimeisen metrin upotukseen käytettiin energiaa 7000 kNm. Koepaalujen upotuksesta ei ollut saatavilla iPiler-lokeja, joten kuvissa 6.12 ja 6.13 esitetty lyöntienergia metrille on vain teoreettinen arvio.

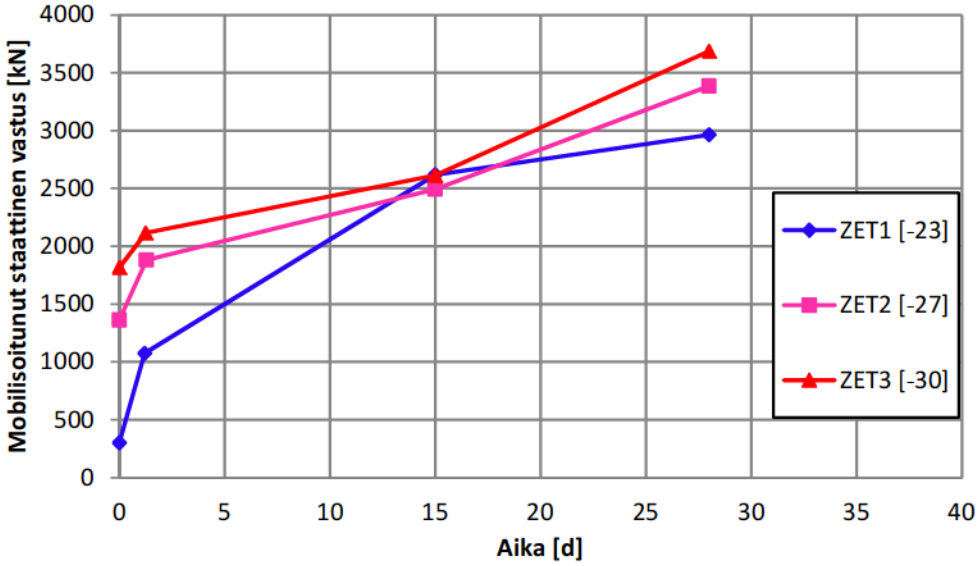
7 Mittaustuloksien ja laskelmien esittely ja analysointi

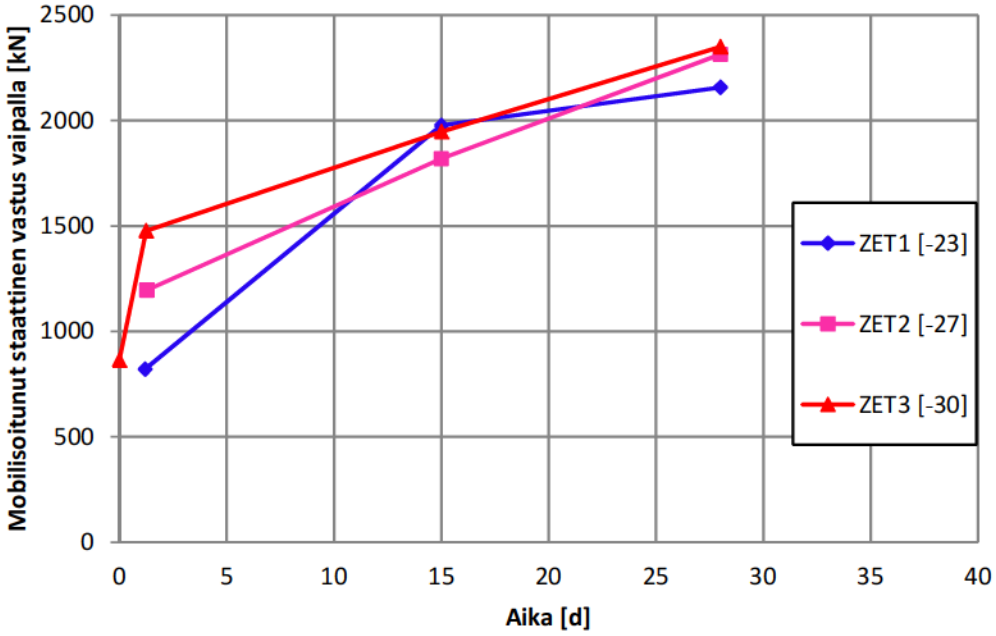
		t=0					t=24 h				t=14 vrk				t=28 vrk			
Paalu	Taso	RMX [kN]	s [mm]	c [mm]	EMX [kNm]	s/10 [mm]	RMX [kN]	s [mm]	c [mm]	EMX [kNm]	RMX [kN]	s [mm]	c [mm]	EMX [kNm]	RMX [kN]	s [mm]	c [mm]	EMX [kNm]
ZET1	-23	301	75	15	68,9	151	1170	25	14	60,6	2551	8	28	68,1	3036	22	38	165,0
ZET2	-27	1363	18	29	63,7	123	1917	9	26	54,3	2436	2	38	69,9	3327	10	49	151,0
ZET3	-30	1814	6	34	59,7	30	2078	4	34	61,9	2549	1	39	70,2	3561	4	48	122,9
ZPT4	-30	454	45	18	63,4	184	1217	19	22	62,2	2555	6	32	72,2	3533	17	43	159,7
ZPT5	-26	480	90	4	74,2	268	1366	23	16	64,4	2726	7	29	71,6	3450	8	46	137,8
ZPT6	-20	303	90	24	75,4	254	1253	29	9	61,7	2738	4	31	71,9	3722	12	35	136,2
ZEB1	-23	864	31	8	35,3	175	1537	12	10	44	2463	6	18	59,4				
ZEB2	-28	535	24	12	33,3	139	1018	17	10	44,6	1954	10	17	62,8				
ZPB3	-20	283	39	7	21,4	210	1207	4	18	37,7	2518	6	18	58,1				
ZPB4	-25	654	55	4	41,7	147	1629	6	16	39,9	2526	5	19	56,2				
TU-T1	-21	1711	17	28	64,3	70	2119	11	28	68,2	2560	7	34	77,6	3085	20	38	145,1
TU-T2	-20	1957	10	32	62,9	35	2318	8	30	66,9	2774	5	33	69,5	2830	24	38	152,3
TU-T3	-19	1595	16	34	68,3	26	1940	13	30	73	2314	15	24	69,9	2479	25	34	136,4
TU-B1	-20	1530	8	19	37,7	30	1635	8	18	46,2	1966	6	24	60,8				
TU-B2	-18	847	18	12	25,9		1079	10	14	32,4	1605	11	19	63,6				

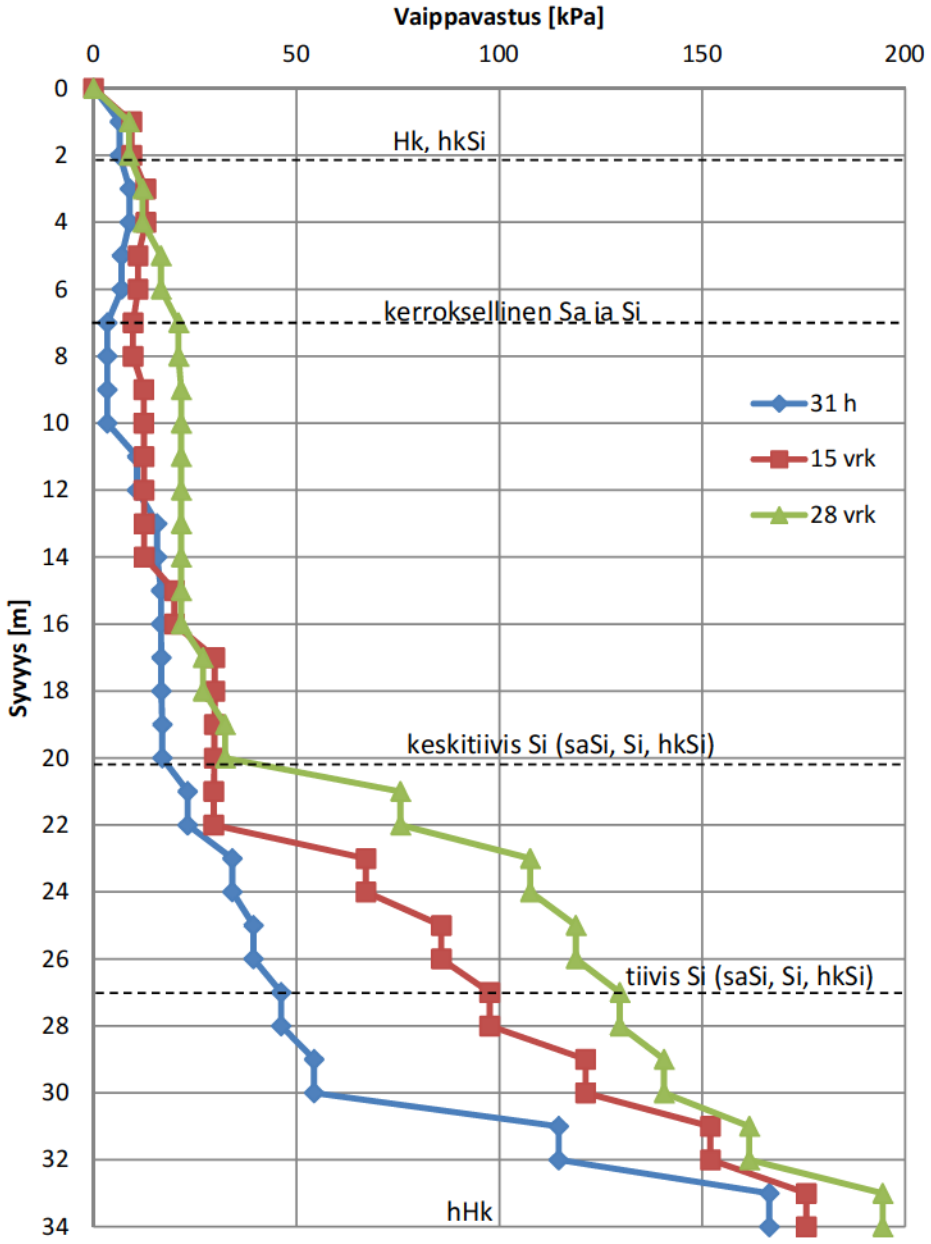
7.2.1 Zatelliitti

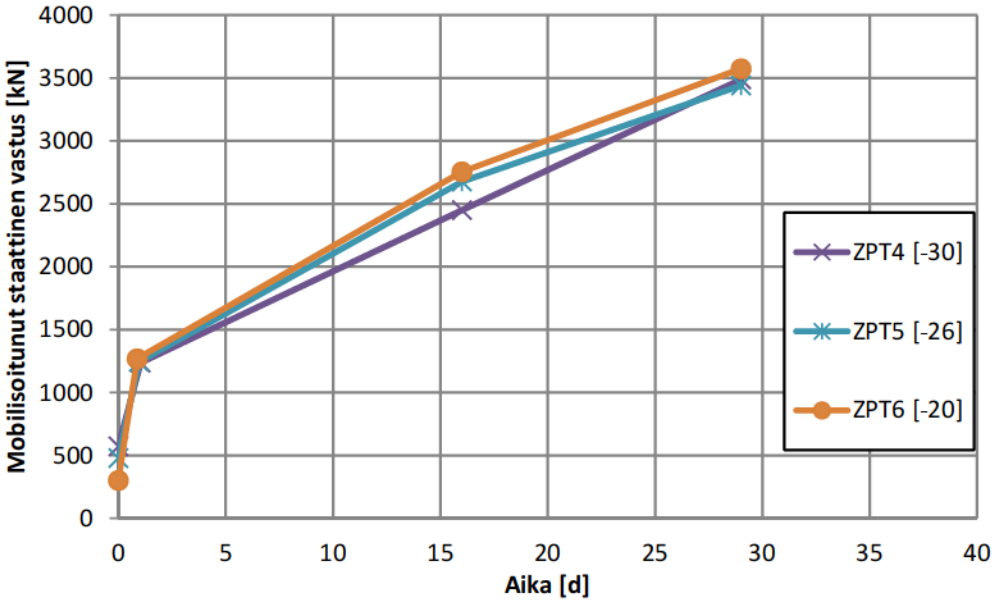

PAALU ZET2
3000
kN
F
7.42
m/s
V
0 h (EOD)
51.2ms
13.70 ms
3000
kN
F
7.42
m/s
V
31 h
51.2ms
13.67 ms
3000
kN
F
7.42
m/s
V
15 vrk
51.2ms
13.67 ms
4000
kN
F
9.89
m/s
V
28 vrk
51.2ms
13.67 ms

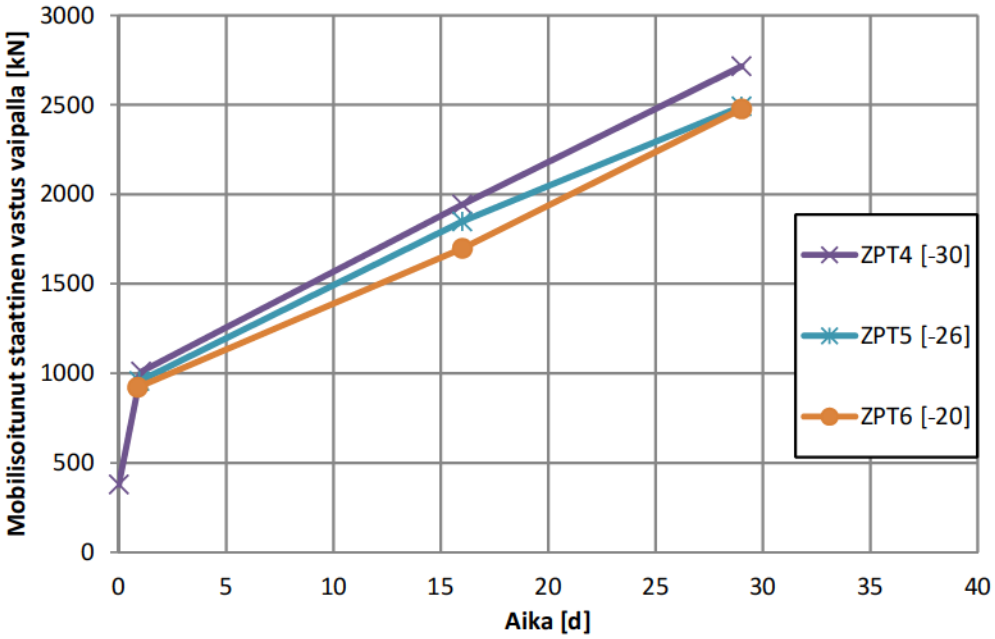
Paalu-tunnus	LE [m]	Aika asennuksesta	Geotekninen kestävyys, Case Method [kN]	Geotekninen kestävyys, CAPWAP [kN]			Painuma per lyönti [mm]	EMX [kNm]
				Yhteensä	Vaippa	Kärki		
ZET1	30,9	EOD	301	301			75	68,9
		29 tuntia	1148	1075	821	254	25	60,6
		15 vuorokautta	2551	2619	1977	642	8	68,1
		28 vuorokautta	3036	2965	2157	808	22	165
ZET2	35	EOD	1363	1363			18	63,7
		31 tuntia	1917	1882	1196	686	9	54,3
		15 vuorokautta	2436	2494	1819	675	2	69,9
		28 vuorokautta	3327	3386	2314	1072	10	151
ZET3	38,8	EOD	1814	1816	863	953	6	59,7
		30 tuntia	2078	2116	1477	639	4	61,9
		15 vuorokautta	2549	2614	1947	667	1	70,2
		28 vuorokautta	3561	3688	2350	1338	3	122,9
ZEB1	31	EOD	864	864			31	35,3
		23 tuntia	1537	1490	747	743	12	44
		15 vuorokautta	2463	2528	1628	900	6	59,4
		28 vuorokautta						
ZEB2	27,5	EOD	977	977			24	33,3
		24 tuntia	1356	1070	281	790	17	44,6
		15 vuorokautta	1954	1626	734	891	10	62,8
		28 vuorokautta						
ZPT4	37,7	EOD	454	572	378	194	45	63,4
		25 tuntia	1217	1238	1009	229	19	62,2
		16 vuorokautta	2555	2450	1943	507	6	72,2
		28 vuorokautta	3533	3489	2716	773	17	159,7
ZPT5	33,6	EOD	480	480			90	74,2
		23 tuntia	1366	1244	957	287	23	64,4
		16 vuorokautta	2726	2676	1849	827	7	71,6
		28 vuorokautta	3450	3441	2492	949	8	137,8
ZPT6	27,6	EOD	303	303			90	75,4
		21 tuntia	1253	1270	922	347	29	61,7
		16 vuorokautta	2738	2755	1698	1057	4	71,9
		28 vuorokautta	3722	3575	2477	1098	12	136,2
ZPB3	27,5	EOD	283	283			39	21,4
		21 tuntia	1203	1219	970	249	4	37,7
		16 vuorokautta	2518	2372	1588	784	6	58,1
		28 vuorokautta						
ZPB4	32,8	EOD	654	654			55	41,7
		22 tuntia	1629	1590	1020	570	6	39,9
		16 vuorokautta	2526	2658	1755	903	5	56,2
		28 vuorokautta						

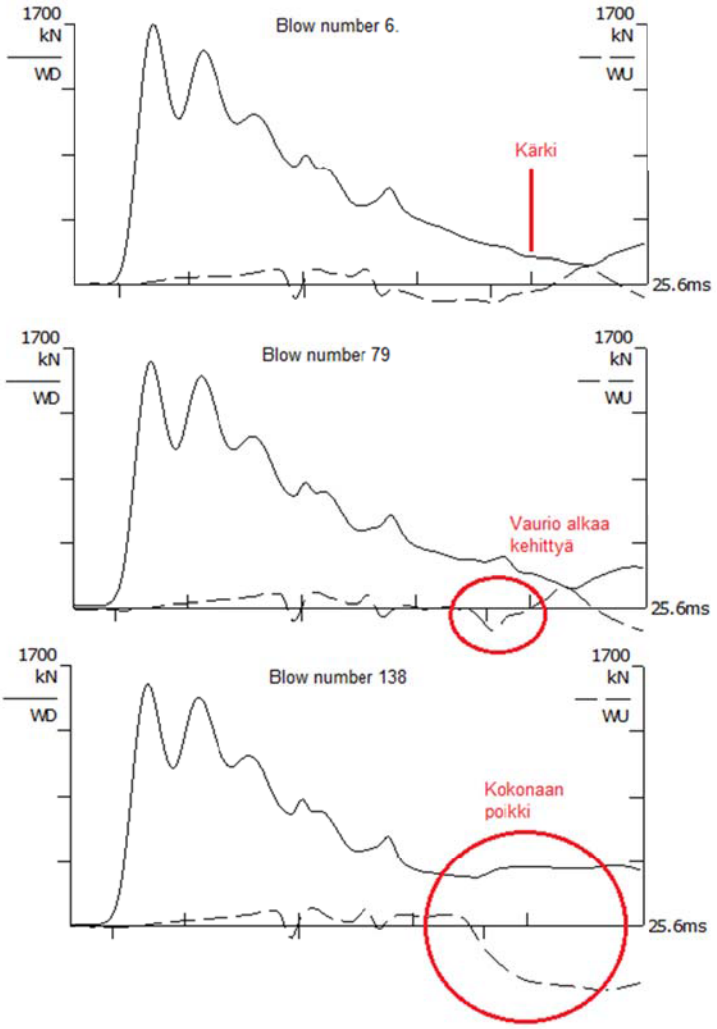

Mobilisoitunut staattinen vastus [kN]
4000
3500
3000
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
Aika [d]
ZET1 [-23]
ZET2 [-27]
ZET3 [-30]

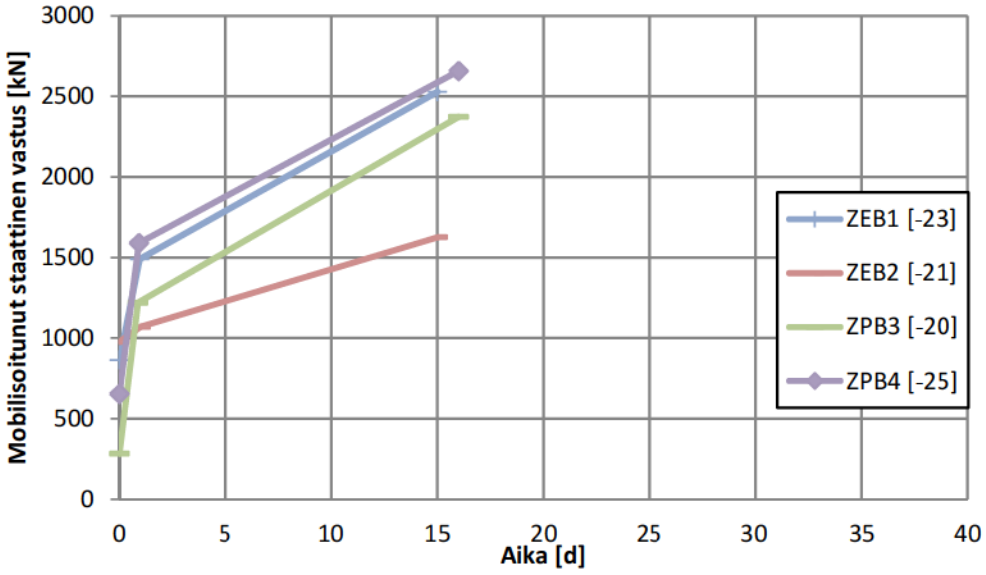

Mobilisoitunut staattinen vastus vaipalla [kN]
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
Aika [d]
ZET1 [-23]
ZET2 [-27]
ZET3 [-30]


Vaippavastus [kPa]
0
50
100
150
200
Syvyys [m]
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
Hk, hkSi
kerroksellinen Sa ja Si
keskitiivis Si (saSi, Si, hkSi)
tiivis Si (saSi, Si, hkSi)
hHk
31 h
15 vrk
28 vrk

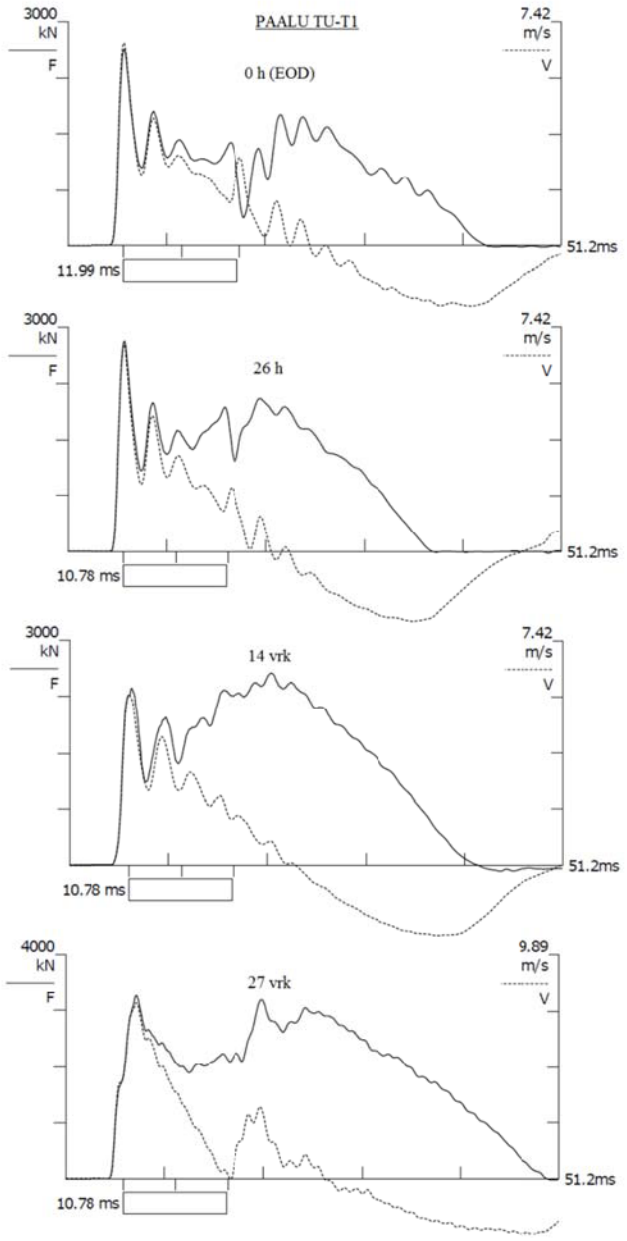

Mobilisoitunut staattinen vastus [kN]
4000
3500
3000
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
Aika [d]
ZPT4 [-30]
ZPT5 [-26]
ZPT6 [-20]


Mobilisoitunut staattinen vastus vaipalla [kN]
3000
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
Aika [d]
ZPT4 [-30]
ZPT5 [-26]
ZPT6 [-20]

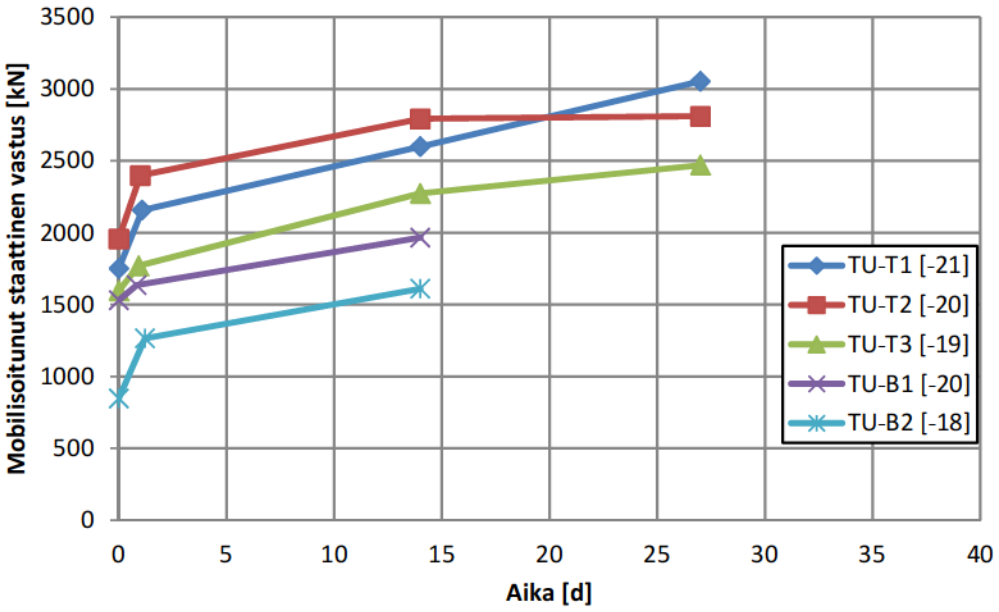

1700
kN
WD
Blow number 6.
1700
kN
WU
Kärki
25.6ms
1700
kN
WD
Blow number 79
1700
kN
WU
Vaurio alkaa
kehittyä
25.6ms
1700
kN
WD
Blow number 138
1700
kN
WU
Kokonaan
poikki
25.6ms

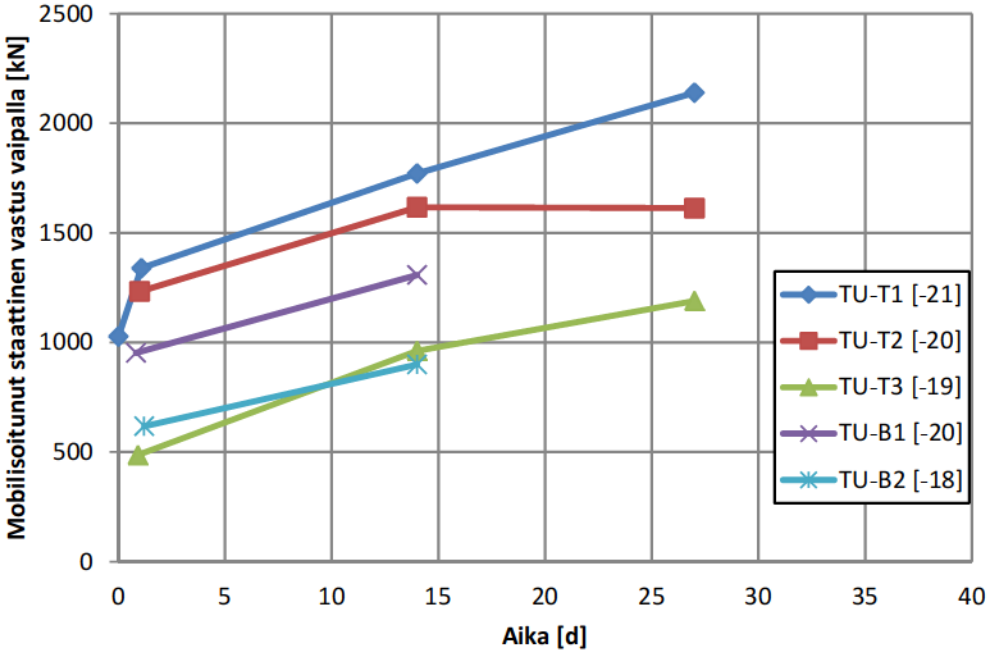

Mobilisoitunut staattinen vastus [kN]
3000
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
Aika [d]
ZEB1 [-23]
ZEB2 [-21]
ZPB3 [-20]
ZPB4 [-25]

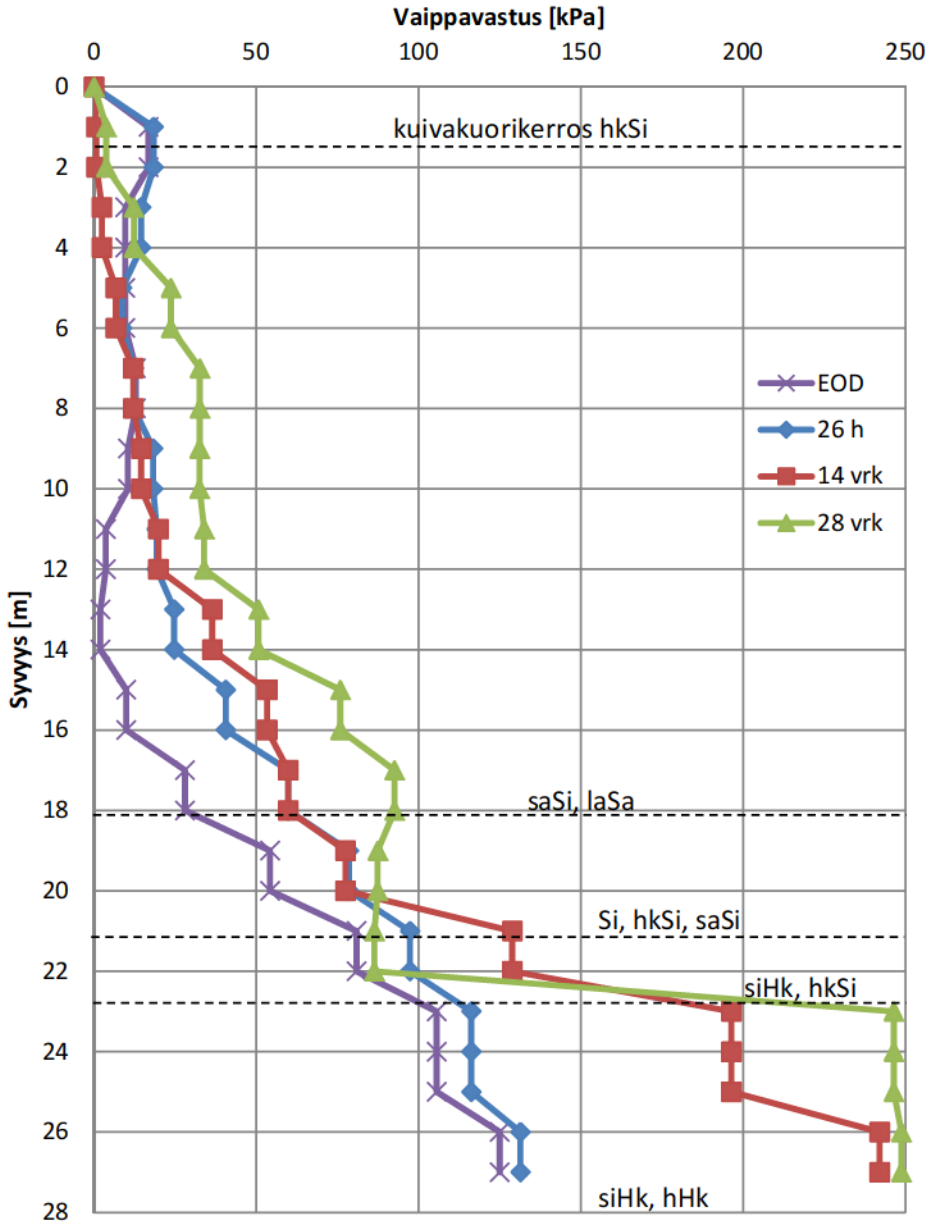
7.2.2 Tuuliharju

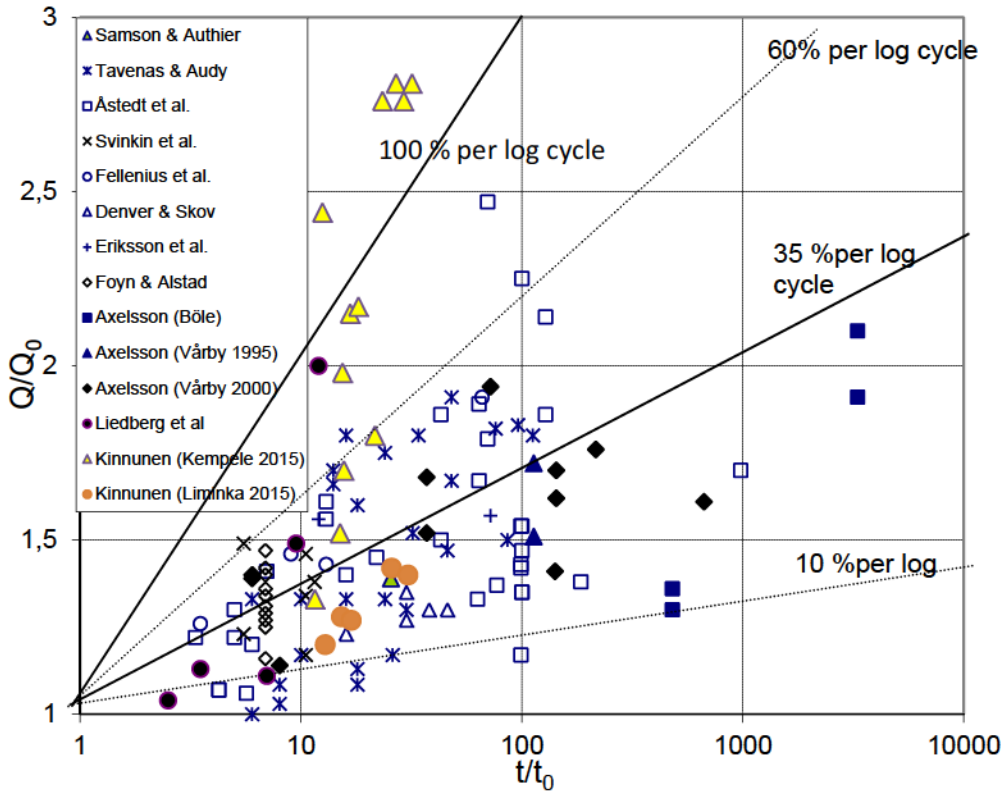

PAALU TU-T1
3000
kN
F
7.42
m/s
V
0 h (EOD)
51.2ms
11.99 ms
3000
kN
F
7.42
m/s
V
26 h
51.2ms
10.78 ms
3000
kN
F
7.42
m/s
V
14 vrk
51.2ms
10.78 ms
4000
kN
F
9.89
m/s
V
27 vrk
51.2ms
10.78 ms

Paalu-tunnus	LE [m]	Aika asennuksesta	Geotekninen kestävyys, Case Method [kN]	Geotekninen kestävyys, CAPWAP [kN]			Painuma per lyönti [mm]	EMX [kNm]
				Yhteensä	Vaippa	Kärki		
TU-T1	30,7	EOD	1711	1751	1027	724	17	64,3
		26 tuntia	2119	2157	1339	818	11	68,2
		14 vuorokautta	2560	2599	1771	828	7	77,6
		28 vuorokautta	3085	3053	2140	913	20	145,1
TU-T2	31,6	EOD	1958	1957			10	62,9
		24 tuntia	2265	2398	1233	1165	8	66,9
		14 vuorokautta	2774	2792	1617	1175	5	69,5
		28 vuorokautta	2830	2810	1613	1197	24	152,3
TU-T3	32,7	EOD	1595	1595			16	68,3
		22 tuntia	1746	1770	487	1283	13	73
		14 vuorokautta	2314	2273	962	1311	15	69,9
		28 vuorokautta	2479	2470	1190	1280	25	136,4
TU-B1	25,9	EOD	1530	1530			8	37,7
		20 tuntia	1635	1662	953	709	8	46,2
		14 vuorokautta	1966	2100	1308	792	6	60,8
		28 vuorokautta						
TU-B2	24,2	EOD	847	847			18	25,9
		29 tuntia	1079	1265	618	647	10	32,4
		14 vuorokautta	1605	1610	900	710	11	63,6
		28 vuorokautta						




Mobilisoitunut staattinen vastus vaipalla [kN]
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
Aika [d]
TU-T1 [-21]
TU-T2 [-20]
TU-T3 [-19]
TU-B1 [-20]
TU-B2 [-18]


Vaippavastus [kPa]
0
50
100
150
200
250
Syvyys [m]
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
kuivakuorikerros hkSi
saSi, laSa
Si, hkSi, saSi
siHk, hkSi
siHk, hHk
EOD
26 h
14 vrk
28 vrk



Q_0

7.2.3 Dynaaminen paalutuskaava

k_3

k_2

k_3

Paalu	LE [m]	RMX [kN]	t=0 s [mm]	c [mm]	EMX [kNm]	s/10 [mm]	k_3	k_2	R_c [kN]	Mitattu / Laskettu RMX / Rc	k_3, jolla vastaavuus
ZET1	30,9	301	75	15	68,9	151	0,6	1	501	0,60	0,36
ZET2	35	1363	18	29	63,7	123	0,6	1	1176	1,16	0,69
ZET3	38,8	1814	6	34	59,7	30	0,6	1	1557	1,16	0,69
ZPT4	37,7	454	45	18	63,4	184	0,6	1	704	0,64	0,38
ZPT5	33,6	480	90	4	74,2	268	0,6	1	484	0,99	0,59
ZPT6	27,6	303	90	24	75,4	254	0,6	1	444	0,68	0,41
ZEB1	31	864	31	8	35,3	175	0,6	0,8	484	1,78	1,07
ZEB2	27,5	535	24	12	33,3	139	0,6	0,8	533	1,00	0,6
ZPB3	27,5	283	39	7	21,4	210	0,6	0,8	242	1,17	0,7
ZPB4	32,8	654	55	4	41,7	147	0,6	0,8	351	1,86	1,12
TU-T1	30,7	1711	17	28	64,3	70	0,6	1	1245	1,37	0,82
TU-T2	31,6	1957	10	32	62,9	35	0,6	1	1452	1,35	0,81
TU-T3	32,7	1595	16	34	68,3	26	0,6	1	1242	1,28	0,77
TU-B1	25,9	1530	8	19	37,7	30	0,6	0,8	1034	1,48	0,88
TU-B2	24	847	18	12	25,9		0,6	0,8	518	1,64	0,98
Paalu	LE [m]	RMX [kN]	t≈24 h s [mm]	c [mm]	EMX [kNm]		k_3	k_2	R_c [kN]	Mitattu / Laskettu RMX / Rc	k_3, jolla vastaavuus
ZET1	30,9	1170	25	14	60,6		0,6	1	1136	1,03	0,62
ZET2	35	1917	9	26	54,3		0,6	1	1481	1,29	0,77
ZET3	38,8	2078	4	34	61,9		0,6	1	1769	1,17	0,7
ZPT4	37,7	1217	19	22	62,2		0,6	1	1244	0,98	0,59
ZPT5	33,6	1366	23	16	64,4		0,6	1	1246	1,10	0,66
ZPT6	27,6	1253	29	9	61,7		0,6	1	1105	1,13	0,68
ZEB1	31	1537	12	10	44		0,6	0,8	1242	1,24	0,74
ZEB2	27,5	1018	17	10	44,6		0,6	0,8	973	1,05	0,63
ZPB3	27,5	1207	4	18	37,7		0,6	0,8	1392	0,87	0,52
ZPB4	32,8	1629	6	16	39,9		0,6	0,8	1368	1,19	0,71
TU-T1	30,7	2119	11	28	68,2		0,6	1	1637	1,29	0,78
TU-T2	31,6	2318	8	30	66,9		0,6	1	1745	1,33	0,8
TU-T3	32,7	1940	13	30	73		0,6	1	1564	1,24	0,75
TU-B1	25,9	1635	8	18	46,2		0,6	0,8	1304	1,25	0,75
TU-B2	24	1079	10	14	32,4		0,6	0,8	915	1,18	0,71

k_3

J_c

t_1

t_1

Paalun Numero	Aika asennuksesta	Geotekninen kestävyys, Case Method [kN]	Geotekninen kestävyys, CAPWAP [kN]			Painuma per lyönti [mm]	Jc
			Yhteensä	Vaippa	Kärki		
ZET1	EOD	301	301			75	
	29 tuntia	1148	1075	821	254	25	0,67
	15 vuorokautta	2551	2619	1977	642	8	0,48
	28 vuorokautta	3036	2965	2157	808	22	0,65
ZET2	EOD	1363	1363			18	
	31 tuntia	1917	1882	1196	686	9	0,62
	15 vuorokautta	2436	2494	1819	675	2	0,49
	28 vuorokautta	3327	3386	2314	1072	10	0,65
ZET3	EOD	1814	1816	863	953	6	0,52
	30 tuntia	2078	2116	1477	639	4	0,58
	15 vuorokautta	2549	2614	1947	667	1	0,51
	28 vuorokautta	3561	3688	2350	1338	3	0,38
ZEB1	EOD	864	864			31	
	23 tuntia	1537	1490	747	743	12	0,6
	15 vuorokautta	2463	2528	1628	900	6	0,56
ZEB2	EOD	977	977			24	
	24 tuntia	1356	1070	281	790	17	0,68
	15 vuorokautta	1954	1626	734	891	10	0,71
ZPT4	EOD	454	572	378	194	45	0,49
	25 tuntia	1217	1238	1009	229	19	0,57
	16 vuorokautta	2555	2450	1943	507	6	0,61
	28 vuorokautta	3533	3489	2715	773	17	0,6
ZPT5	EOD	480	480			90	
	23 tuntia	1366	1244	957	287	23	0,73
	16 vuorokautta	2726	2676	1849	827	7	0,61
	28 vuorokautta	3450	3441	2492	949	8	0,6
ZPT6	EOD	303	303			90	
	21 tuntia	1253	1270	922	347	29	0,56
	16 vuorokautta	2738	2755	1698	1057	4	0,56
	28 vuorokautta	3722	3575	2477	1098	12	0,66
ZPB3	EOD	283	283			39	
	21 tuntia	1203	1219	970	249	4	0,6
	16 vuorokautta	2518	2372	1588	784	6	0,65
ZPB4	EOD	654	654			55	
	22 tuntia	1629	1590	1020	570	6	0,61
	16 vuorokautta	2526	2658	1755	903	5	0,53
TU-T1	EOD	1711	1751	1027	724	17	0,4
	26 tuntia	2119	2157	1339	818	11	0,55
	14 vuorokautta	2560	2599	1771	828	7	0,49
	28 vuorokautta	3085	3053	2140	913	20	0,6
TU-T2	EOD	1958	1957			10	
	24 tuntia	2265	2398	1233	1165	8	0,35
	14 vuorokautta	2774	2792	1617	1175	5	0,44
	28 vuorokautta	2830	2810	1613	1197	24	0,59
TU-T3	EOD	1595	1595			16	
	22 tuntia	1746	1770	487	1283	13	0,53
	14 vuorokautta	2314	2273	962	1311	15	0,61
	28 vuorokautta	2479	2470	1190	1280	25	0,59
TU-B1	EOD	1530	1530			8	
	20 tuntia	1635	1662	953	709	8	0,5
	14 vuorokautta	1966	2100	1308	792	6	0,47
TU-B2	EOD	847	847			18	
	29 tuntia	1079	1265	618	647	10	0,5
	14 vuorokautta	1605	1610	900	710	11	0,6

7.5.1 Zatelliitti

Zatelliitti					Laskettu	
Menetelmä	Kairauspiste	Paalu	Paalupituus [m]	Vaippa [kN]	Kärki [kN]	Yhteensä [kN]
Staattinen kantavuuskaava	R756	ZPT4	37	3446	1236	4680
kriittinen syvyys 10*D	R756	ZPT4	37	666	869	1535
kriittinen syvyys 20*D	R756	ZPT4	37	1249	1236	2485
Heijarikairaus	R756	ZPT4	37	2305	1229	3530
Puristin-heijarikairaus	R747	ZPT4	37	2717	494	3211
					Laskettu 7 vrk	
Puristinkairaus	VR09	ZET1	14	490	93	537
ICP-method	VR09	ZET1	14	324	86	410
					Mitattu 28 vrk	
Kairauspiste	Paalu			Vaippa [kN]	Kärki [kN]	Yhteensä [kN]
R756	ZPT4			2716	773	3489
R747	ZPT4			2716	773	3489
					Mitattu 7 vrk	
VR09	ZET1					687

Menetelmä	Mitattu/Laskettu Vaippa	Mitattu/Laskettu Kärki	Mitattu/Laskettu Yhteensä
Staattinen kantavuuskaava	0,79	0,63	0,75
kriittinen syvyys 10*D	4,08	0,89	2,27
kriittinen syvyys 20*D	2,17	0,63	1,40
Heijarikairaus	1,18	0,63	0,99
Puristin-heijarikairaus	1,00	1,56	1,09
Puristinkairaus			1,28
ICP-method			1,68

7.5.2 Tuuliharju

Tuuliharju					Laskettu	
Menetelmä	Kairauspiste	Paalu	Paalupituus [m]	Vaippa [kN]	Kärki [kN]	Yhteensä [kN]
Staattinen kantavuuskaava	S31	TU-B2	23	1336	1350	2686
Puristin-heijarikairaus	S31	TU-B2	23	768	360	1128
Staattinen kantavuuskaava	S31	TU-T3	24	1285	1236	2521
Puristin-heijarikairaus	S31	TU-T3	24	732	329	1061
					Mitattu 14 vrk	
Kairauspiste	Paalu			Vaippa [kN]	Kärki [kN]	Yhteensä [kN]
S31	TU-B2			900	710	1605
					Mitattu 28 vrk	
S31	TU-T3			1190	1280	2470
Menetelmä	Mitattu/Laskettu Vaippa		Mitattu/Laskettu Kärki		Mitattu/Laskettu Yhteensä	
Staattinen kantavuuskaava	0,67		0,53		0,60	
Puristin-heijarikairaus	1,17		1,97		1,42	
Staattinen kantavuuskaava	0,93		1,04		0,98	
Puristin-heijarikairaus	1,63		3,89		2,33	

			Mitattu [kN]			Laskettu [kN]		Mitattu/Laskettu		Empiirinen kerroin
	Paalu	L [m]	Q_o	$Q_{t\approx14\,vrk}$	$Q_{t\approx28\,vrk}$	$Q_{t\approx14\,vrk}$	$Q_{t\approx28\,vrk}$	≈14 vrk	≈28 vrk	14 vrk / 28 vrk
Skov & Denver (1998) Kerroin A Kaava 4.12	ZET1	30	1075	2619	2965	2615	2942	1,00	1,01	1,25 / 1,2
	ZET2	35	1882	2494	3386	2529	3380	0,99	1,00	0,3 / 0,55
	ZET3	38	2116	2614	3688	2601	3647	1,00	1,01	0,2 / 0,5
	ZPT4	37	1238	2450	3489	2444	3477	1,00	1,00	0,85 / 1,25
	ZPT5	32	1244	2676	3441	2670	3404	1,00	1,01	1 / 1,2
	ZPT6	27	1270	2755	3575	2726	3567	1,01	1,00	1,0 / 1,25
	ZEB1	30	1490	2528		2515		1,01		0,6
	ZEB2	36	1070	1626		1622		1,00		0,45
	ZPB3	27	1219	2372		2407		0,99		0,85
	ZPB4	25	1590	2658		2683		0,99		0,6
	TU-T1	26	2157	2599	3053	2651	3093	0,98	0,99	0,2 / 0,3
	TU-T2	25	2398	2792	2810	2810	2745	0,99	1,02	0,15 / 0,1
	TU-T3	24	1770	2273	2470	2277	2410	1,00	1,02	0,25 / 0,25
	TU-B1	25	1662	2100		2138		0,98		0,25
	TU-B2	23	1265	1610		1627		0,99		0,25
Svinki (1996) Kaava 4.14	ZET1	30	1075	2619	2965	2589	2925	1,01	1,01	1,85 / 1,95
	ZET2	35	1882	2494	3386	2450	3414	1,02	0,99	1,0 / 1,3
	ZET3	38	2116	2614	3688	2617	3691	1,00	1,00	0,95 / 1,25
	ZPT4	37	1238	2450	3489	2498	3455	0,98	1,01	1,55 / 2,0
	ZPT5	32	1244	2676	3441	2672	3385	1,00	1,02	1,65 / 1,95
	ZPT6	27	1270	2755	3575	2728	3544	1,01	1,01	1,65 / 2,0
	ZEB1	30	1490	2528		2522		1,00		1,3
	ZEB2	36	1070	1626		1602		1,01		1,15
	ZPB3	27	1219	2372		2381		1,00		1,5
	ZPB4	25	1590	2658		2691		0,99		1,3
	TU-T1	26	2157	2599	3053	2528	3085	1,03	0,99	0,9 / 1,025
	TU-T2	25	2398	2792	2810	2810	2844	0,99	0,99	0,9 / 0,85
	TU-T3	24	1770	2273	2470	2305	2532	0,99	0,98	1,0 / 1,025
	TU-B1	25	1662	2100		2056		1,02		0,95
	TU-B2	23	1265	1610		1647		0,98		1
Alawneh et al. (2009) φ = 33 ° Kaava 4.15	ZET1	30	1075	2619	2965	1695	1838	1,55	1,61	
	ZET2	35	1882	2494	3386	3149	3441	0,79	0,98	
	ZET3	38	2116	2614	3688	3663	4019	0,71	0,92	
	ZPT4	37	1238	2450	3489	2140	2334	1,14	1,49	
	ZPT5	32	1244	2676	3441	2028	2196	1,32	1,57	
	ZPT6	27	1270	2755	3575	1945	2090	1,42	1,71	
	ZEB1	30	1490	2528		2350		1,08		
	ZEB2	36	1070	1626		1811		0,90		
	ZPB3	27	1219	2372		1867		1,27		
	ZPB4	25	1590	2658		2373		1,12		
	TU-T1	26	2157	2599	3053	3208	3470	0,81	0,88	
	TU-T2	25	2398	2792	2810	3522	3858	0,79	0,73	
	TU-T3	24	1770	2273	2470	2566	2765	0,89	0,89	
	TU-B1	25	1662	2100		2441		0,86		
	TU-B2	23	1265	1610		1810		0,89		

s/10 [mm]	A
0-50	0,2
50-100	0,3
100-150	0,4
150-200	0,5
200-250	0,6
250-300	0,7

	Paalu	L [m]	s/10 [mm]	Q_o	Mitattu [kN]		Laskettu [kN]		Mitattu/Laskettu		Empiirinen kerroin A
					$Q_{t\approx 14\,vrk}$	$Q_{t\approx 28\,vrk}$	$Q_{t\approx 14\,vrk}$	$Q_{t\approx 28\,vrk}$	≈14 vrk	≈28 vrk	14 vrk / 28 vrk
	ZET1	30	151	1075	2619	2965	1691	1853	1,55	1,60	0,5
	ZET2	35	123	1882	2494	3386	2745	2699	0,91	1,25	0,4
	ZET3	38	30	2116	2614	3688	2601	2728	1,00	1,35	0,2
	ZPT4	37	184	1238	2450	3489	1947	2134	1,26	1,64	0,5
Skov &	ZPT5	32	268	1244	2676	3441	2242	2504	1,19	1,37	0,7
Denver	ZPT6	27	254	1270	2755	3575	2289	2557	1,20	1,40	0,7
(1998)	ZEB1	30	175	1490	2528		2344		1,08		0,5
Kerroin	ZEB2	36	139	1070	1626		1561		1,04		0,4
A	ZPB3	27	210	1219	2372		2057		1,15		0,6
Kaava	ZPB4	25	147	1590	2658		2319		1,15		0,4
4.12	TU-T1	26	70	2157	2599	3053	2899	3093	0,90	0,99	0,3
	TU-T2	25	35	2398	2792	2810	2948	3092	0,95	0,91	0,2
	TU-T3	24	26	1770	2273	2470	2176	2282	1,04	1,08	0,2
	TU-B1	25	30	1662	2100		2043		1,03		0,2
	TU-B2	23		1265	1610		1555		1,04		0,2

Kitkapaalut

	Paalut	Tavoitetaso	Pituus [m]
T1	3 kpl	-27	32
T2	3 kpl	-27	32
T3	3 kpl	-27	32
T4	3 kpl	-27	32
Yht.	12 kpl		128

Tukipaalut

	Paalut	Tavoitetaso	Pituus [m]
T1	3 kpl	-40	45
T2	3 kpl	-40	45
T3	3 kpl	-40	45
T4	3 kpl	-40	45
Yht .	12 kpl		180

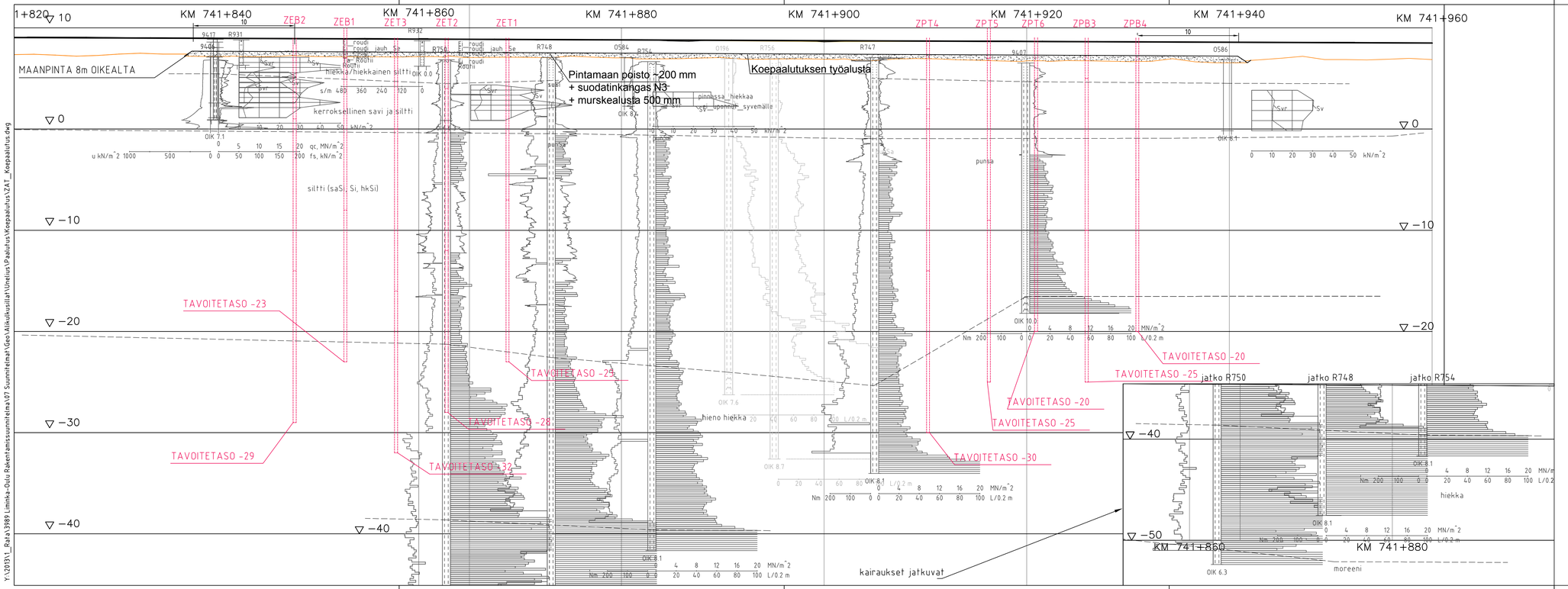
	Metrihinta	
Teräsputkipaalu D813 t16,0 mm	600	€/m

Erotus paalupituuksissa = 52 m

Kitkapaaluilla säästöä = 52 m * 600 €/m = 31 200 €

8 Johtopäätökset

-
-
-
-



Liite 1 / 1 (3)

Vain koepaalutusta varten

Muut.	Selitys	Pvm	Tehnyt	Pvm	Hyv.

Tilaaja: Liikennevirasto

Hanke tai rataosa: RATAHANKE SEINÄJOKI-OULU

Toimittaja: VR TRACK

Suunnitteluvaihe: Rakentamissuunnitelma

Piirustuksen sisältö:
PITUUSLEIKKAUS
KMV 741+820-741+960
ZATELLIITIN AKS, koepaalutuks
KAIRAUKSET OIKEALTA

Rataosuus Liminka-Oulu

Piirt.	7.11.2014	Katja Punkari, A. Tuominen
Suunn.	7.11.2014	Arttu Tuominen
Tark.	7.11.2014	Seppo Hakala
Hyv.	7.11.2014	Hannu Siira

Tarkastaja: WSP

Tark.	xx	xxxxx
Hyv.	xx	xxxxx
LV hyv.	xx	

Mittakaava: 1:200

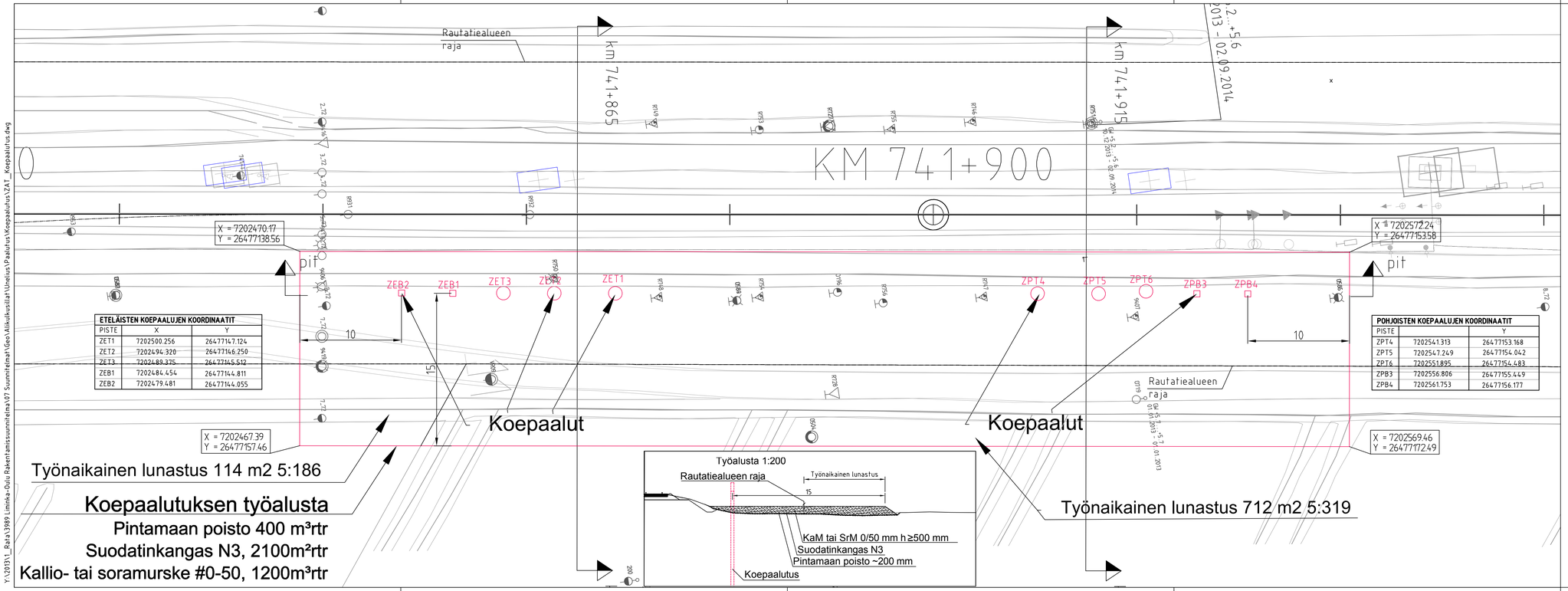
Koordinaatti- ja korkeusjärj.: ETRS GK26/N2000

Rataosan nro: SK-OL

Paikka	Laji	Numero	Muut.	Lehti	Lehtiä
4034	GEO		-	2	

Y:\2013\1_Rata\3989 Liminka-Oulu Rakentamissuunnitelma\07 Suunnitelmat\Geo\Aktiviteetit\Tiehallinto\Paalutus\Koepaalutus\ZAT_Koepaalutus.dwg

Vain koepaalutusta varten



ETELÄISTEN KOEPAALUJEN KOORDINAATIT

PISTE	X	Y
ZET1	7202500.256	2647714 7.124
ZET2	7202494.320	2647714 6.250
ZET3	7202489.375	2647714 5.512
ZEB1	7202484.454	2647714 4.811
ZEB2	7202479.481	2647714 4.055

POHJOISTEN KOEPAALUJEN KOORDINAATIT

PISTE		Y
ZPT4	7202541.313	2647715 3.168
ZPT5	7202547.249	2647715 4.042
ZPT6	7202551.895	2647715 4.683
ZPB3	7202556.806	2647715 5.449
ZPB4	7202561.753	2647715 6.177

Muut.	Selitys	Pvm	Tehnyt	Pvm	Hyv.

Tilaaja: Liikennevirasto

Toimittaja: VR TRACK

Piirt.	7.11.2014	Katja Punkari, A. Tuominen
Suunn.	7.11.2014	Arttu Tuominen
Tark.	7.11.2014	Seppo Hakala
Hyv.	7.11.2014	Hannu Siira

Tarkastaja: WSP

Tark.	xx	xxxxx
Hyv.	xx	xxxxx
LV hyv.	xx	

Hanke tai rataosa: RATAHANKE SEINÄJOKI-OULU

Suunnitteluvaihe: Rakentamissuunnitelma

Piirustuksen sisältö: POHJATUTKIMUSKARTTA
Koepaalutus
ZATELLIITIN AKS

Rataosuus Liminka-Oulu

Mittakaava: 1:200

Koordinaatti- ja korkeusjärj.: ETRS GK26/N2000

Rataosan nro: SK-OL

Paikka	Laji	Numero	Muut.	Lehti	Lehtiä
4034	GEO		-	1	

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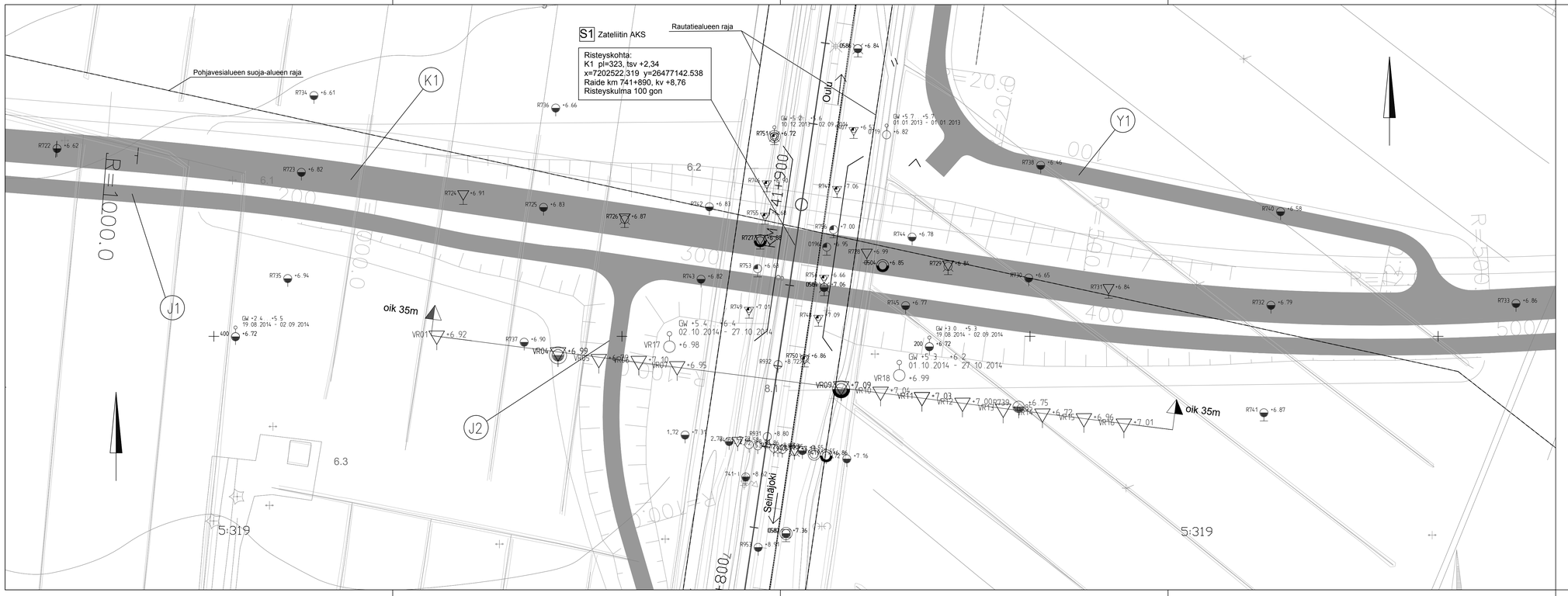


Muut.	Selitys	Pvm	Tehnyt	Pvm	Hyv.

Tilaaja: Liikennevirasto

Toimittaja: VR TRACK

Piirt.	29.10.2014	Satu Joronen
Suunn.	29.10.2014	Johanna Martio
Tark.		Seppo Hakala
Hyv.		Heikki Akkanen

Tarkastaja: PÖYRY

Tark.		
Hyv.		
LV hyv.		

Hanke tai rataosa: RATAHANKE SEINÄJOKI-OULU

Suunnitteluvaihe: Rakentamissuunnitelma

Piirustuksen sisältö: Zatelliitin alikulkusilta ja tiejärjestelyt
Pohjatutkimuskartta

Rataosuus Liminka-Oulu

Mittakaava: 1:500

Koordinaatti- ja korkeusjärj.: ETRS GK26/N2000

Rataosan nro: SK-OL

Paikka	Laji	Numero	Muut.
4034	GEO	18221	- 1 2

TAMPEREEN TEKNILLINEN YLIOPISTO
Rakennustekniikan laitos
Maa- ja pohjarakenteet

TESTAUSSELOSTUS MPR/7/2014 1(2)

Nuutti Vuorimies 040 720 3050

06-03-2014

VR Track Oy
Seppo Hakala / Antti Ikonen
PL 42
00232 Helsinki

Tilaus 14.1.2014
Unelius AKS R751, pisteen R571 rasialeikkauskokeet

Näytteet

Tilaaja toimitutti Matkahuollon kautta pisteestä R571 (x = 7202548.981, y = 26477137.360) seitsemän näytettä muovipusseissa, jotka vastaanotettiin TTY:llä 14.1.2014. Näytteet olivat syvyyksiltä 32 - 33 m, 37 - 38 m, 42 - 43 m, 52 - 53 m, 62 - 63 m, 63 - 65 m ja 65 - 68,13 m. TTY:lle toimitettujen näytteiden edustavuus on tilaajan vastuulla. TTY:ssä näytteille tehtiin kokeet työnumerolla 7/2014 ja kokeiden tallentamisessa käytettiin tiedostotunnusta I7.

Näytteiden esikäsittely

Ennen testausta näytteet säilytettiin jääkaapissa.

Testausmenetelmä

Rasialeikkauskokeet tehtiin TTY:n rasialeikkauskoelaitteistolla, jossa koekappaleen sivumitat olivat 60 mm, noudattaen teknistä spesifikaatiota CEN ISO/TS 17892-10:fi. Koekappaleen korkeus oli kuitenkin suurempi kuin korkeuden suhde leveyteen sallisi. Myöskään rasian puoliskoja ei ole erotettu toisistaan nostamalla erilleen ennen leikkauksen alkamista.

Tulokset

Rasialeikkauskokeet tehtiin näytteille pisteestä R571 syvyydeltä 37 - 38 m, 42 - 43 m, 52 - 53 m ja 62 - 63 m vaakasuuntaisen leikkausnopeuden ollessa 0,015 mm/min. Ennen koekappaleiden rakentamista syvyydeltä 62 - 63 m tehdyistä näytteistä poistettiin yli 4 mm rakeet, joita oli käsitellyssä osanäytteessä noin 19 %. Koekappaleet tiivistettiin näytteiden vallitsevassa vesipitoisuudessa käsin sullomalla mahdollisimman tiiviiksi. Tiivistettäessä rasian koekappaleiden pohjalta erottautui hieman vettä. Koekappaleista ei ole määritetty huokoslukuja. Tuloksissa ei ole esitetty huokoslukuihin liittyviä graafisia kuvaajia eikä taulukoituja arvoja maksimileikkausjännityksille.

TAMPEREEN TEKNILLINEN YLIOPISTO
Rakennustekniikan laitos
Maa- ja pohjarakenteet

Nuutti Vuorimies 040 720 3050

06-03-2014

Rasialeikkauskokeiden tulokset on esitetty liitteissä 1 - 4. Syvyyden 37 - 38 m näytteelle (liite 1) määritettiin suurimmilla leikkausjännityksillä lujuusparametreiksi kitkakulma 33,7° ja koheesio 57,7 kPa, kun kuivatilavuuspaino oli noin 18,5 kN/m^3. Syvyyden 42 - 43 m näytteelle (liite 2) määritettiin suurimmilla leikkausjännityksillä lujuusparametreiksi kitkakulma 36,1° ja koheesio 38,6 kPa, kun kuivatilavuuspaino oli noin 19,1 kN/m^3. Syvyyden 52 - 53 m näytteelle (liite 3) määritettiin suurimmilla leikkausjännityksillä lujuusparametreiksi kitkakulma 39,6° ja koheesio 10,8 kPa, kun kuivatilavuuspaino oli 17,9 - 18,3 kN/m^3. Syvyyden 62 - 63 m näytteelle, josta oli yli 4 mm rakeet poistettu, (liite 4) määritettiin suurimmilla leikkausjännityksillä lujuusparametreiksi kitkakulma 40,9° ja koheesio 33,4 kPa, kun kuivatilavuuspaino oli noin 20,2 - 20,6 kN/m^3.

Kokeet tehtiin 22.1. - 12.2.2014. Alustavat koetulokset lähettiin sähköpostilla 2. ja 6. ja 12.2.2014. Tulokset pätevät ainoastaan testatuille näytteille. Testausselostuksen saa kopioida ainoastaan kokonaisuudessaan.

Projektipäällikkö Nuutti Vuorimies

Laboratoriomestari Niko Levo

JAKELU Tilaajat
TTY

LIITTEET
Liite 1. Syvyyden 37 - 38 m rasialeikkauskokeen tulokset (6 sivua)
Liite 2. Syvyyden 42 - 43 m rasialeikkauskokeen tulokset (5 sivua)
Liite 3. Syvyyden 52 - 53 m rasialeikkauskokeen tulokset (5 sivua)
Liite 4. Syvyyden 62 - 63 m rasialeikkauskokeen tulokset (5 sivua)

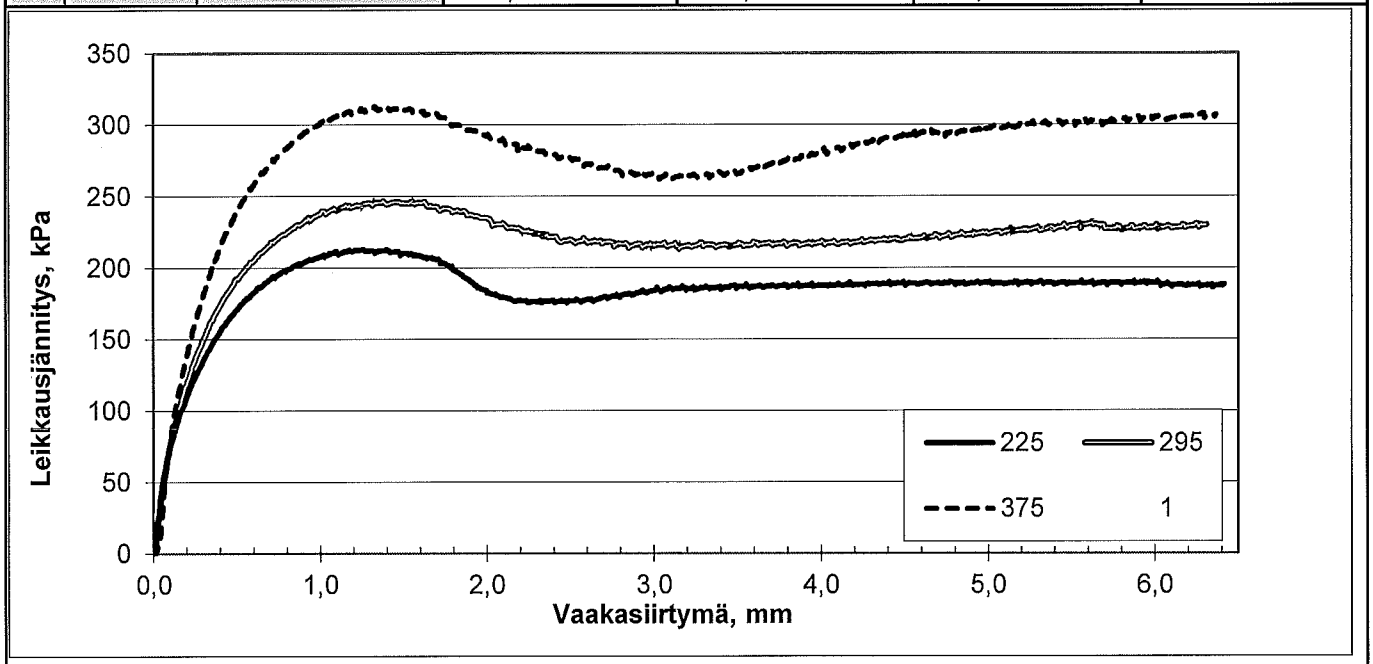
MPR 7/2014 Liite 1. 1 / 6

RASIALEIKKAUSKOE

Tampereen teknillinen yliopisto	**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteet	**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE	**TYÖNUMERO**	**7/2014 (I7)**

Päivämäärä: 22.1.14

Tilaajan työnumero/projektinumero:								
Piste, paalu:	**R571**							
Syvyys:	**37 - 38 m**							
Maalaji:	siHk/hiHk		siHk/hiHk		siHk/hiHk		siHk/hiHk	
Tiedosto:	I7_R11		I7_R12		I7_R13			
Leikkausnopeus [mm/min]	0,015		0,015		0,015			
Normaalijännitys [kPa]	225		295		375			
Koenumero	**1**	w	**2**	w	**3**	w	**4**	w
Alkupaino ja vesipitoisuus [g]	230,4	16,5 %	228,0	18,0 %	228,9	18,0 %		
[g]								
Paino kuivana [g]	197,81		193,25		194,87			
Näytteen korkeus [mm]	29,36		28,33		28,70			
Alkutilavuus [cm3]	105,70		101,99		103,32			
Tilavuuspaino	21,4 kN/m3		21,9 kN/m3		21,7 kN/m3			kN/m3
Kuivatilavuuspaino	18,4 kN/m3		18,6 kN/m3		18,5 kN/m3			kN/m3
Alkukokoonpurist [mm]	0,04		0,16		0,15			
Kuivatilavuuspaino konsolid.	18,4 kN/m3		18,7 kN/m3		18,6 kN/m3			kN/m3
Vesipitoisuus lopussa	18,7 %		19,0 %		19,2 %			



3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

HUOM: Näytteet tiivistetty tiiviiksi. Tiivistyksessä pinnalle erottunut hieman vettä. Rasialeikkauslaatikko täytetty vedellä. Odotettu hetken aikaa ja konsolidoitu.

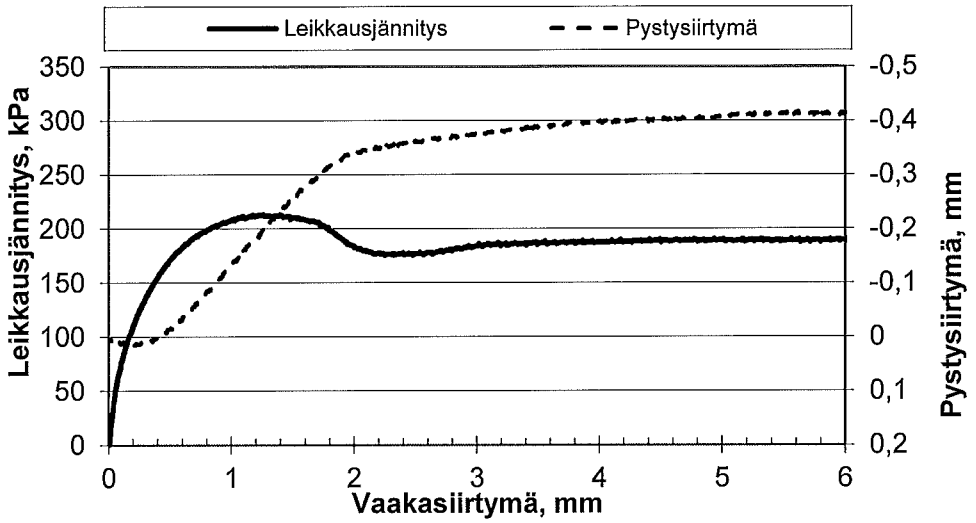
MITTASI: TAMPERE 6.3.2014 Niko Levo
PAIKKA PÄIVÄYS Laboratoriomestari

TARKASTI: TAMPERE 6.3.2014 NUUTTI VUORIMIES
PAIKKA PÄIVÄYS Projektipäällikkö, DI

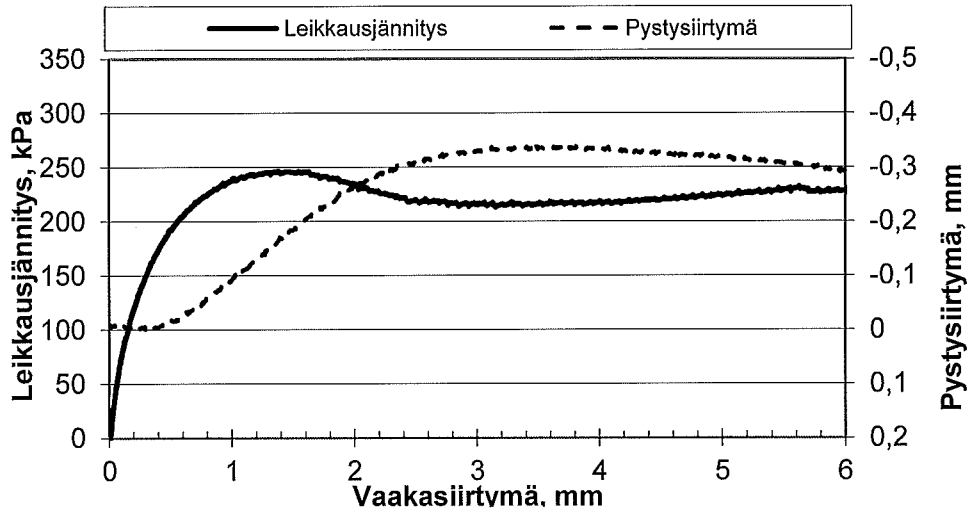
RASIALEIKKAUSKOE

Tampereen teknillinen yliopisto	ASIAKAS	VR Track Oy
Maa- ja pohjarakenteet	KOHDE	Unelius R571
PL 600 33101 TAMPERE	TYÖNUMERO	7/2014 (I7)

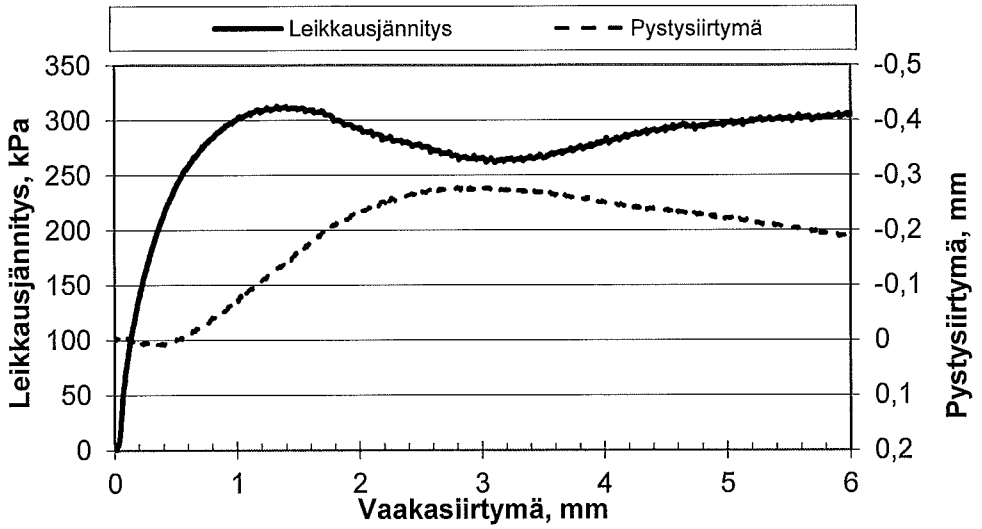
I7_R11



I7_R12



I7_R13

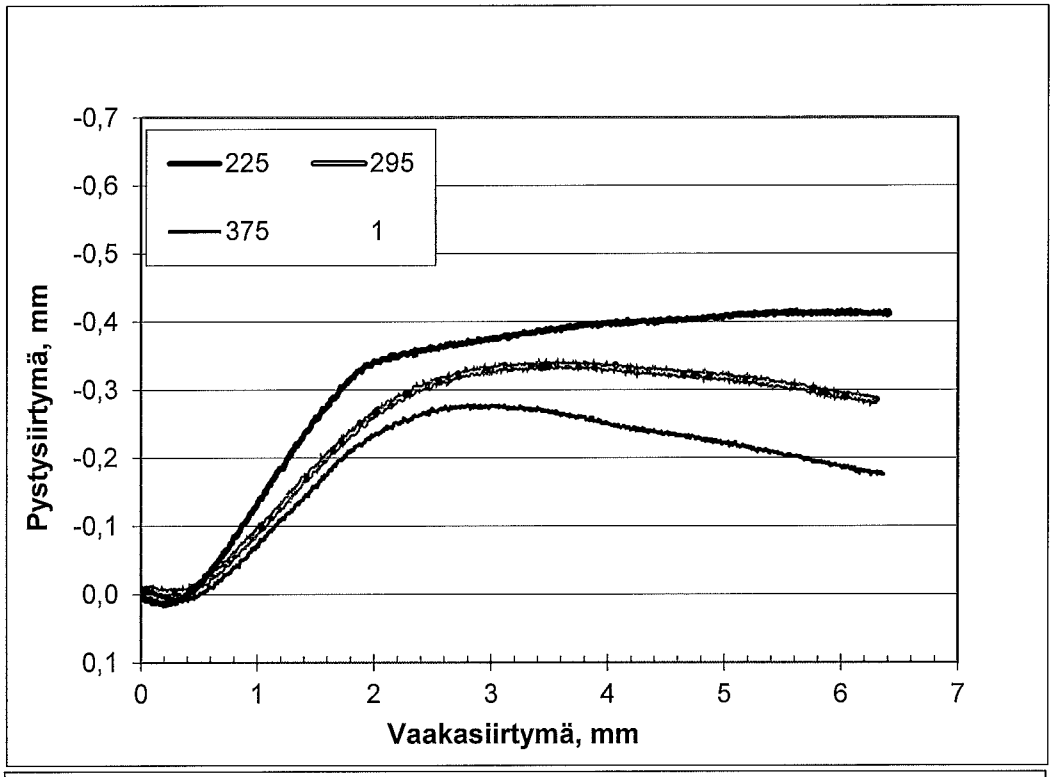


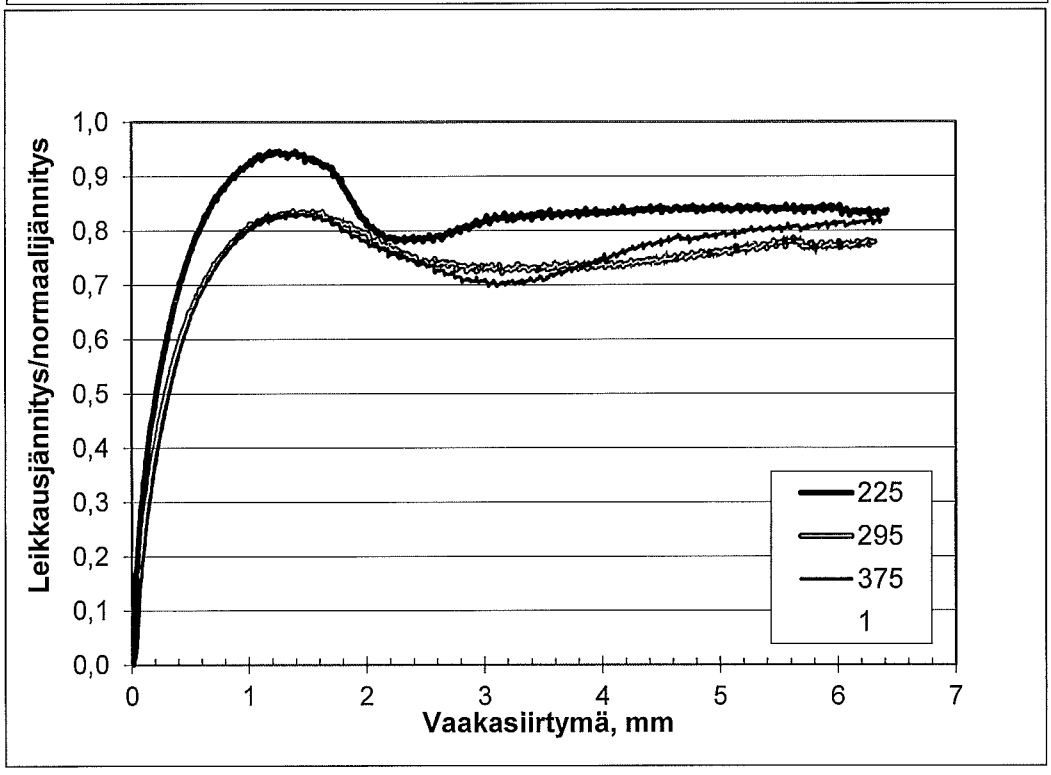
3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

RASIALEIKKAUSKOE

Tampereen teknillinen yliopisto		**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteet		**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE		**TYÖNUMERO**	**7/2014 (I7)**

siHk/hiHk piste: **R571** syvyys: **37 - 38 m** m





3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

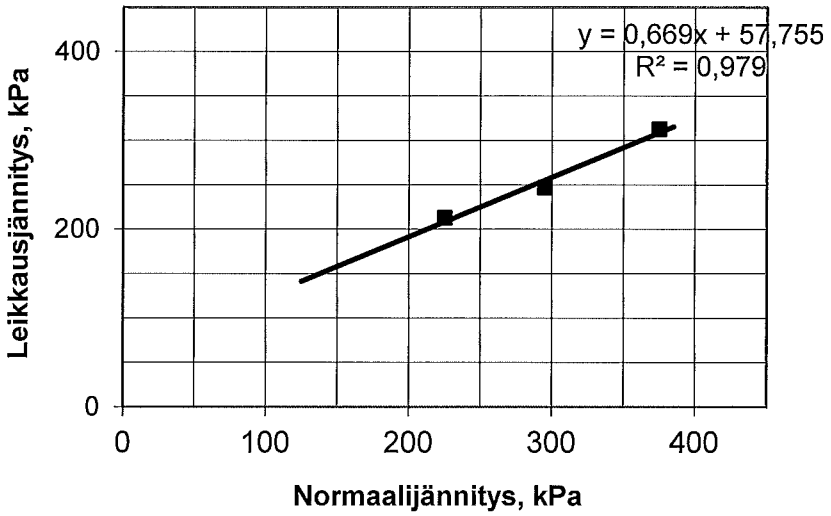
Tiedostot: I7_R11
I7_R12
I7_R13

RASIALEIKKAUSKOE

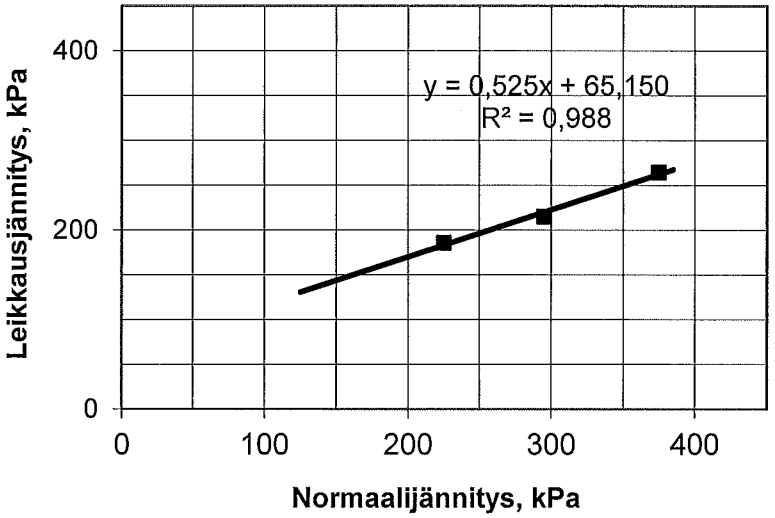
Tampereen teknillinen yliopisto	**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteet	**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE	**TYÖNUMERO**	**7/2014 (I7)**

siHk/hiHk piste: **R571** syvyys: **37 - 38 m**

Suurimmalla leikkausjännityksillä
Kitkakulma φ = 33,7 astetta ja koheesio c= 57,7 kPa



Leikkausmuodonmuutos 5,5 % (3.3 mm)
Kitkakulma φ = 27,7 astetta ja koheesio c = 65,1 kPa



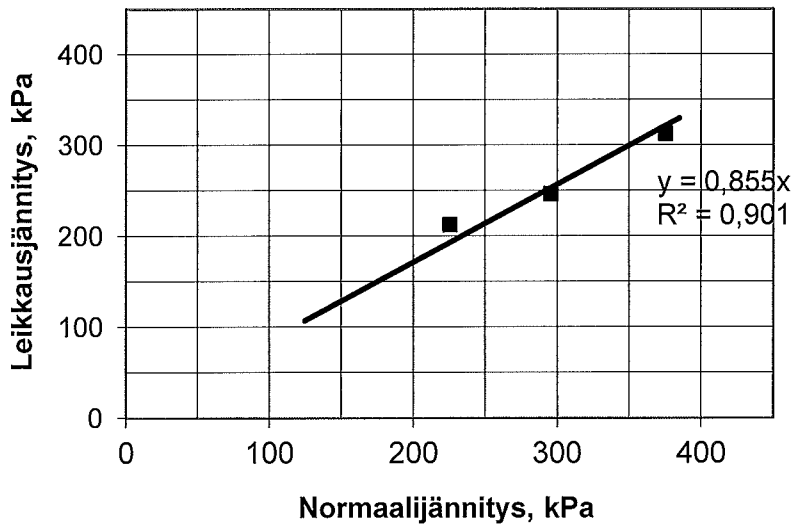
3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

Tiedostot: I7_R11
I7_R12
I7_R13

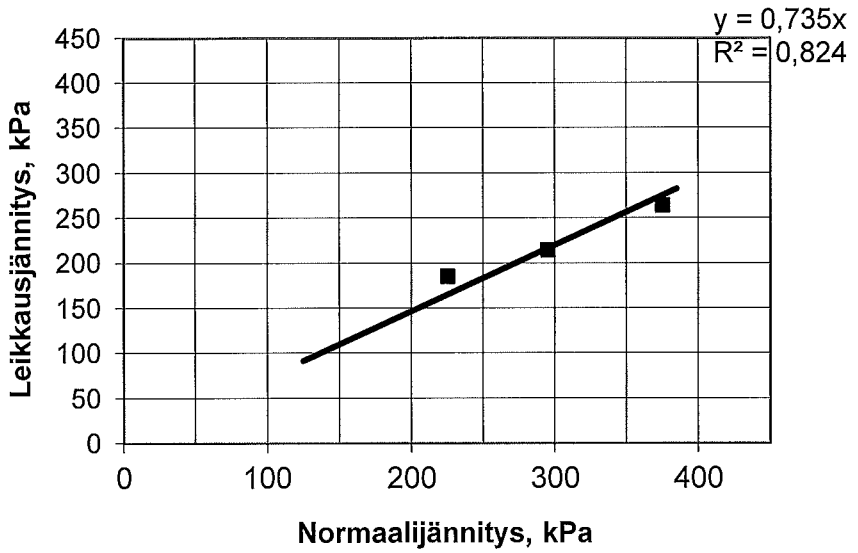
RASIALEIKKAUSKOE

Tampereen teknillinen yliopisto	ASIAKAS	VR Track Oy
Maa- ja pohjarakenteiden laitos	KOHDE	Unelius R571
PL 600 33101 TAMPERE	TYÖNUMERO	7/2014 (I7)

Suurin leikkausjännitys, koheesio pakotettu nollaksi
Kitkakulma φ = 40,5 astetta



Jäännöskitkakulma 3,3 mm (5,5 %) siirtymällä, koheesio pakotettu nollaksi:
Kitkakulma φ = 36,3 astetta



Tiedostot: I7_R11
I7_R12
I7_R13

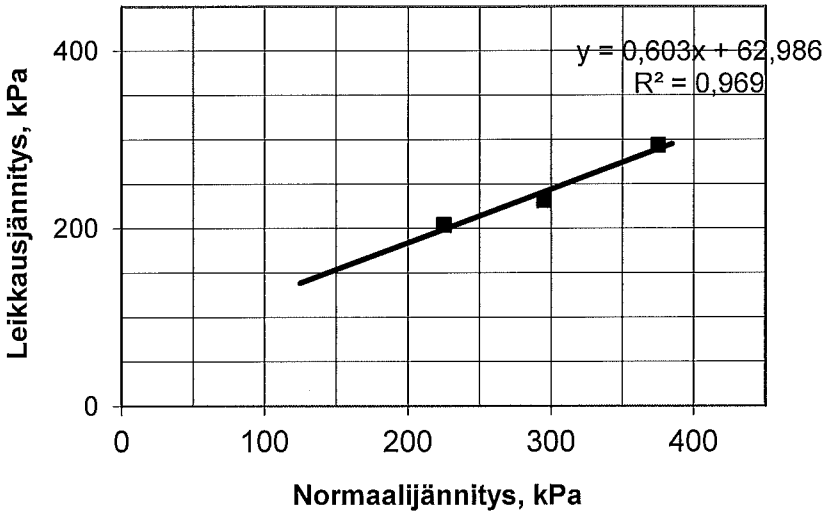
0

RASIALEIKKAUSKOE

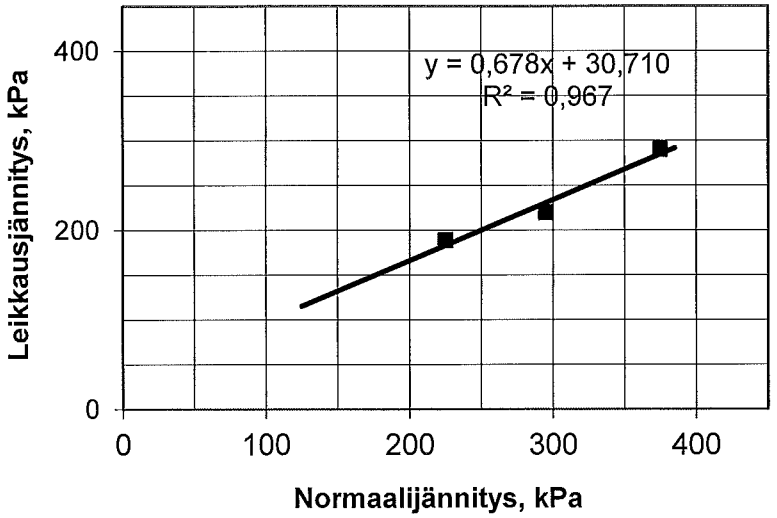
Tampereen teknillinen yliopisto		**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteet		**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE		**TYÖNUMERO**	**7/2014 (I7)**

siHk/hiHk piste: **R571** syvyys: **37 - 38 m**

Leikkausmuodonmuutos 1,5 % (0.9 mm)
Kitkakulma φ = 31,0 astetta ja koheesio c= 62,9 kPa



Leikkausmuodonmuutos 7,5 % (4.5 mm)
Kitkakulma φ = 34,1 astetta ja koheesio c = 30,7 kPa



3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

Tiedostot: I7_R11
I7_R12
I7_R13

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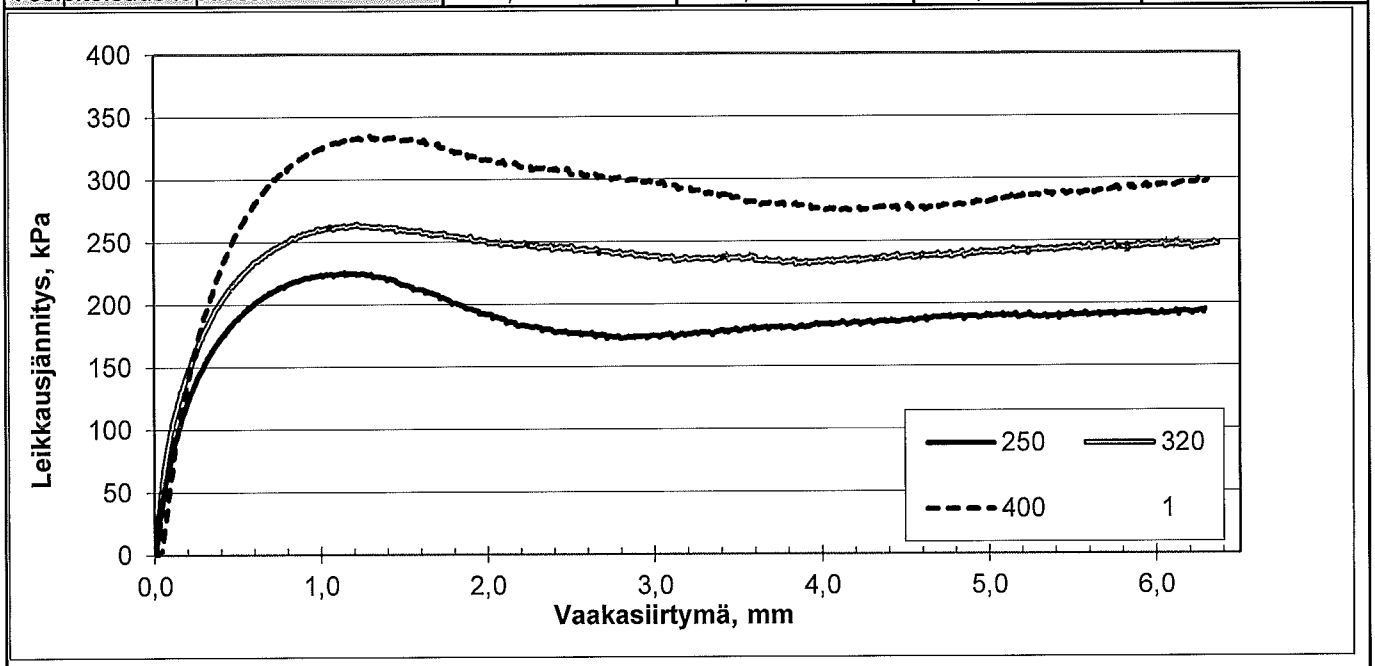
RASIALEIKKAUSKOE

Tampereen teknillinen yliopisto	**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteet	**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE	**TYÖNUMERO**	**7/2014 (I7)**

Päivämäärä: 22.1.14

Tilaajan työnumero/projektinumero:								
Piste, paalu:	**R571**							
Syvyys:	**42-43**							
Maalaji:	Hiekka		Hiekka		Hiekka		Hiekka	
Tiedosto:	I7_R6		I7_R7		I7_R8			
Leikkausnopeus [mm/min]	0,015		0,015		0,015			
Normaalijännitys [kPa]	250		320		400			
Koenumero	**1**	w	**2**	w	**3**	w	**4**	w
Alkupaino ja vesipitoisuus [g]	229,8	15,7 %	229,0	15,6 %	228,8	15,6 %		
[g]								
Paino kuivana [g]	198,68		198,03		196,83			
Näytteen korkeus [mm]	28,32		28,35		28,12			
Alkutilavuus [cm3]	101,95		102,06		101,23			
Tilavuuspaino	22,1 kN/m3		22,0 kN/m3		22,2 kN/m3			kN/m3
Kuivatilavuuspaino	19,1 kN/m3		19,0 kN/m3		19,1 kN/m3			kN/m3
Alkukokoonpurist [mm]	0,08		0,16		0,28			
Kuivatilavuuspaino konsolid.	19,2 kN/m3		19,1 kN/m3		19,3 kN/m3			kN/m3
Vesipitoisuus lopussa	17,1 %		17,5 %		17,4 %			



3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

HUOM: Näytteet tiivistetty tiiviiksi. Tiivistyksessä pinnalle erottunut hieman vettä. Rasialeikkauslaatikko täytetty vedellä. Odotettu hetken aikaa ja konsolidoitu.

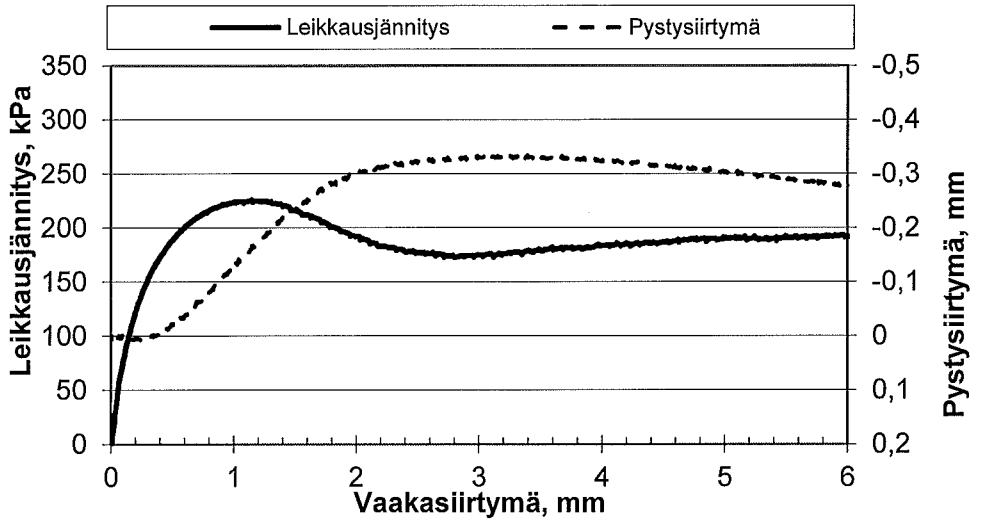
MITTASI: TAMPERE 6.3.2014 Niko Levo
PAIKKA PÄIVÄYS Laboratoriomestari

TARKASTI: TAMPERE 6.3.2014 NUUTTI VUORIMIES
PAIKKA PÄIVÄYS Projektipäällikö, DI

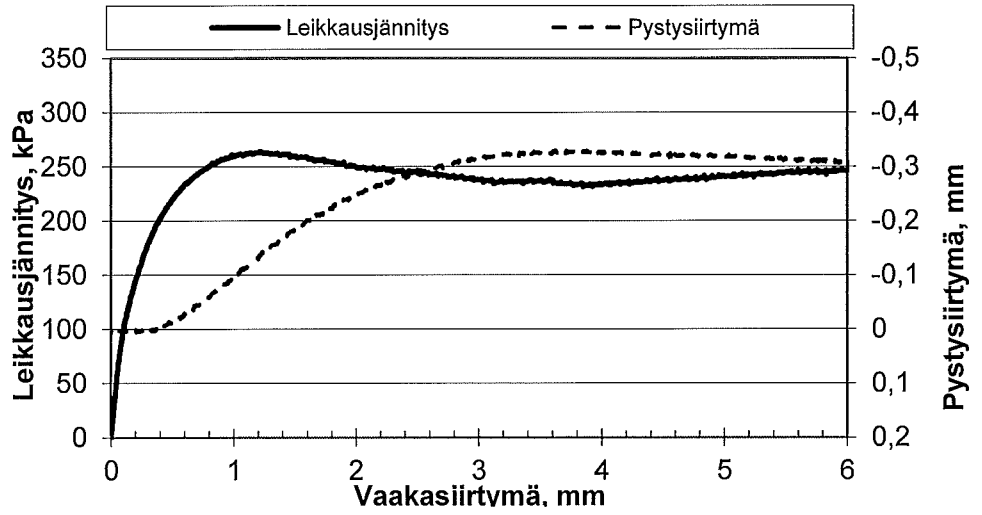
RASIALEIKKAUSKOE

Tampereen teknillinen yliopisto		**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteet		**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE		**TYÖNUMERO**	**7/2014 (I7)**

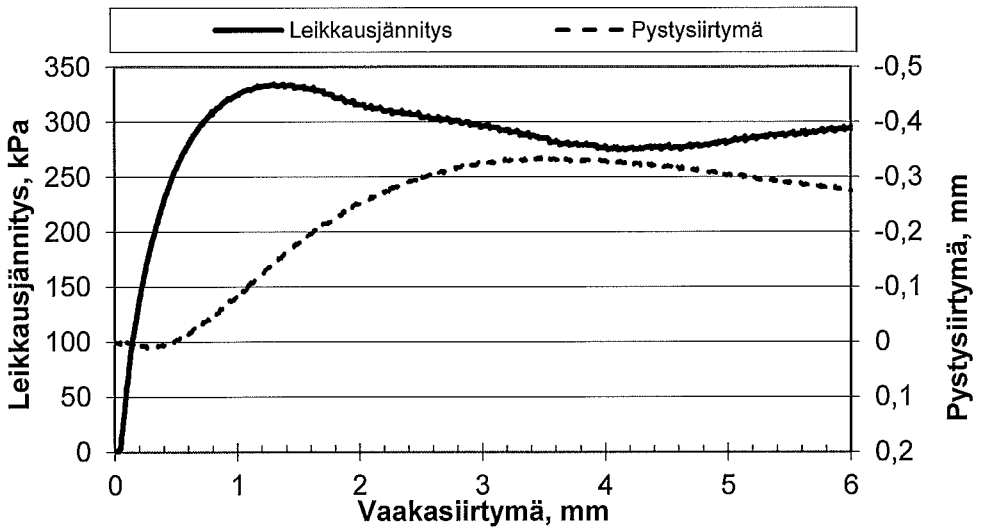
I7_R6



I7_R7



I7_R8

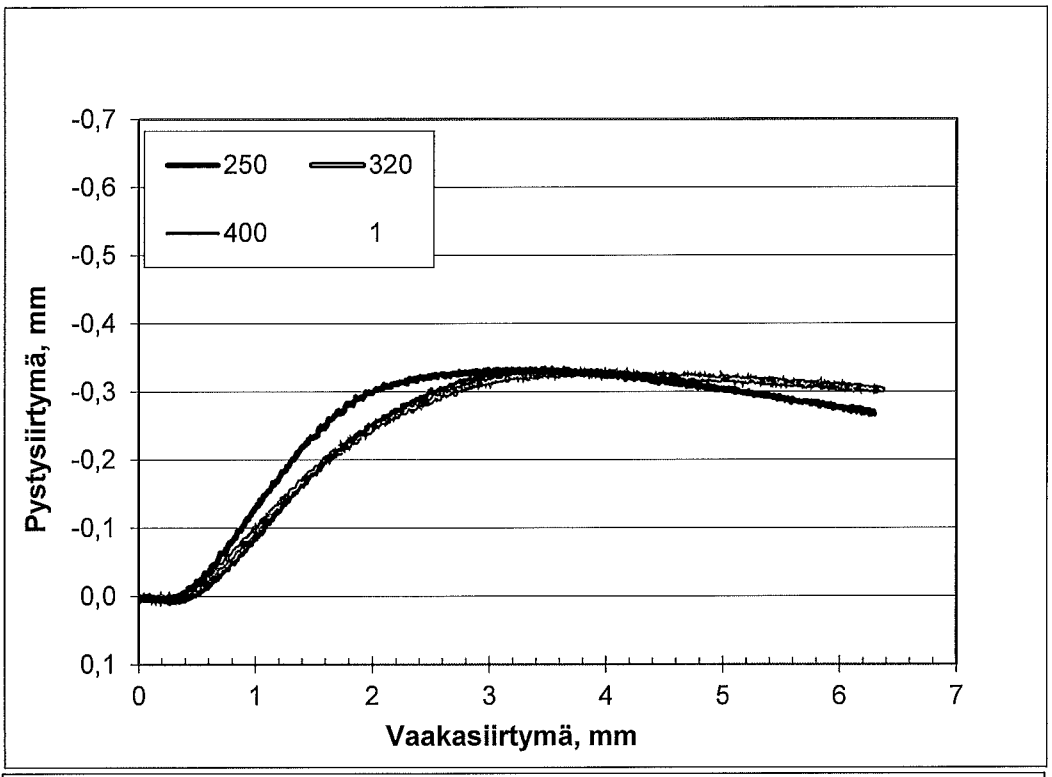


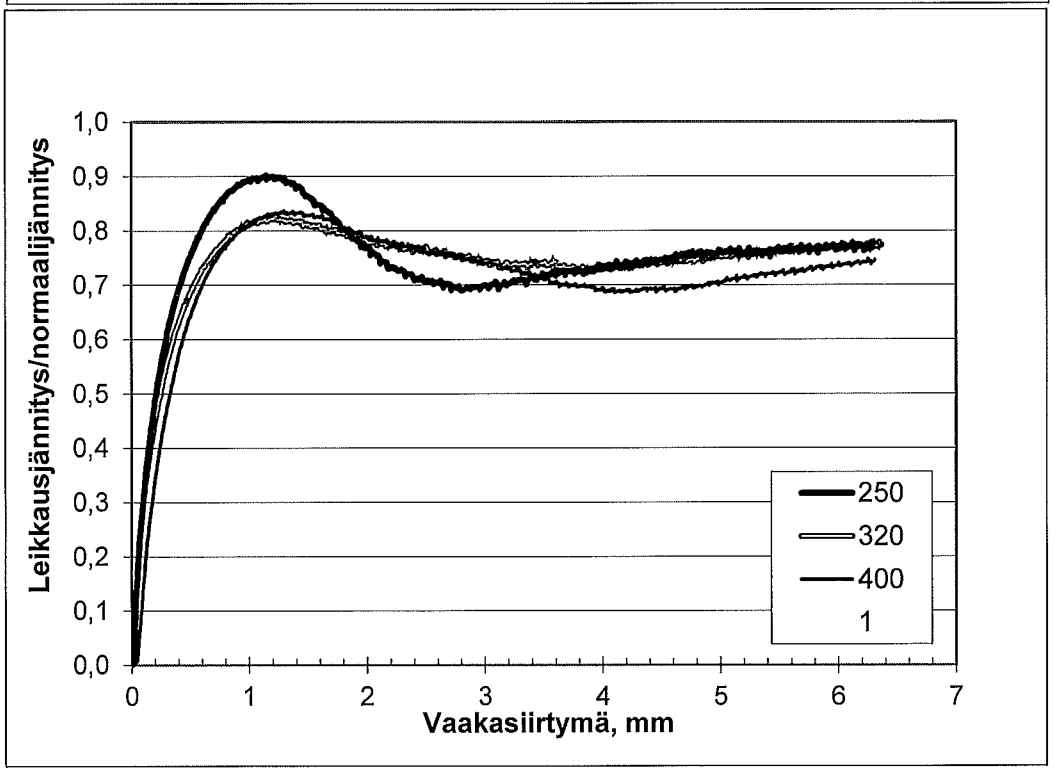
3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

RASIALEIKKAUSKOE

Tampereen teknillinen yliopisto	**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteet	**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE	**TYÖNUMERO**	**7/2014 (I7)**

Hiekka piste: **R571** syvyys: **42-43** m





3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

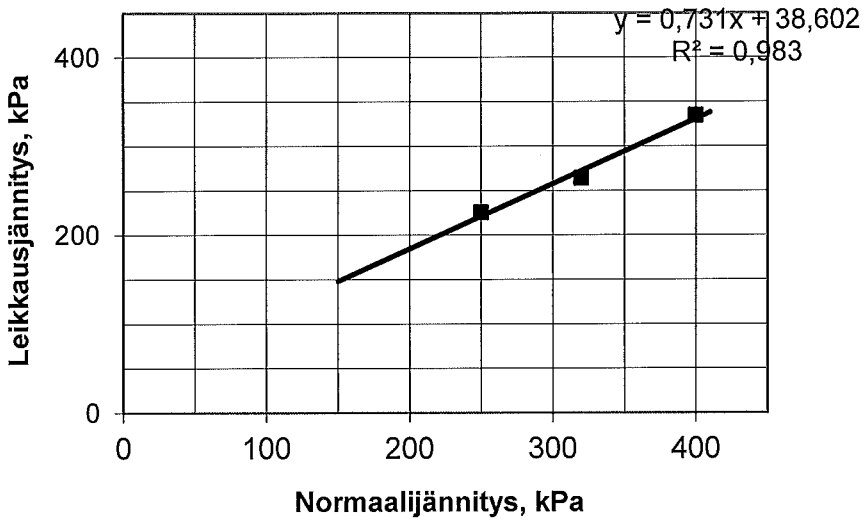
Tiedostot: I7_R6
I7_R7
I7_R8

RASIALEIKKAUSKOE

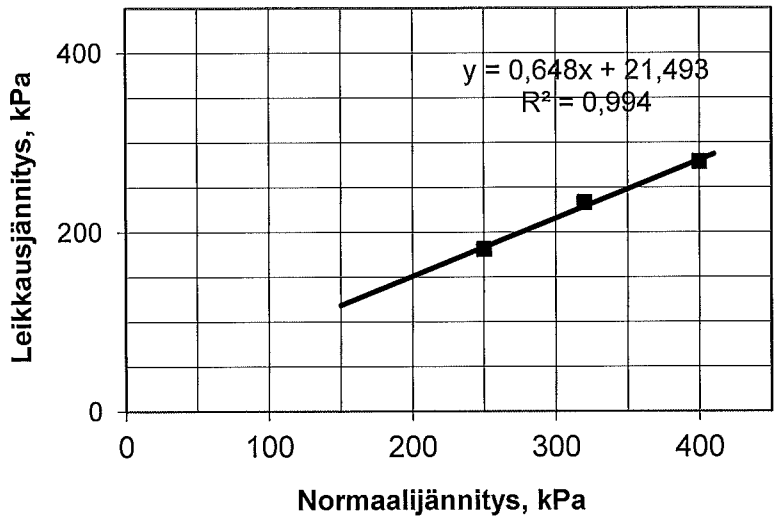
Tampereen teknillinen yliopisto	**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteet	**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE	**TYÖNUMERO**	**7/2014 (I7)**

Hiekka piste: **R571** syvyys: **42-43**

Suurimmalla leikkausjännityksillä
Kitkakulma φ = 36,1 astetta ja koheesio c= 38,6 kPa



Leikkausmuodonmuutos 6,5 % (3.9 mm)
Kitkakulma φ = 32,9 astetta ja koheesio c = 21,4 kPa



3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

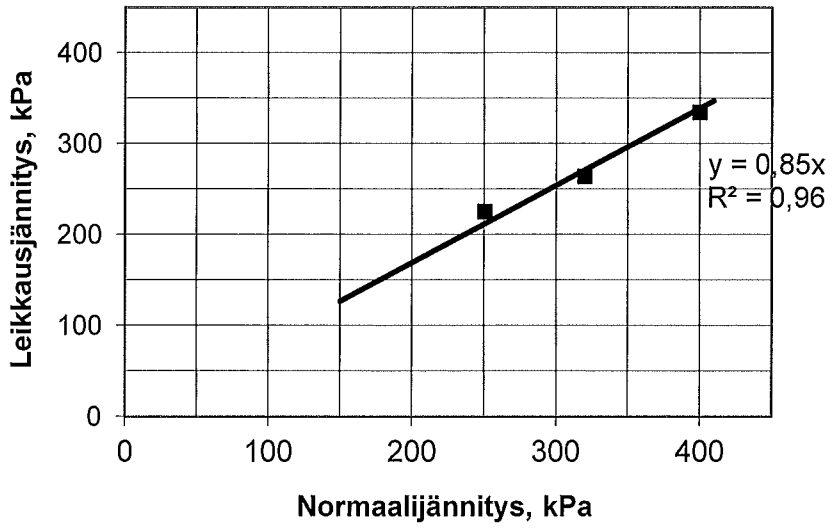
Tiedostot: I7_R6
I7_R7
I7_R8

MPR 7/2014 Liite 2. 5/5

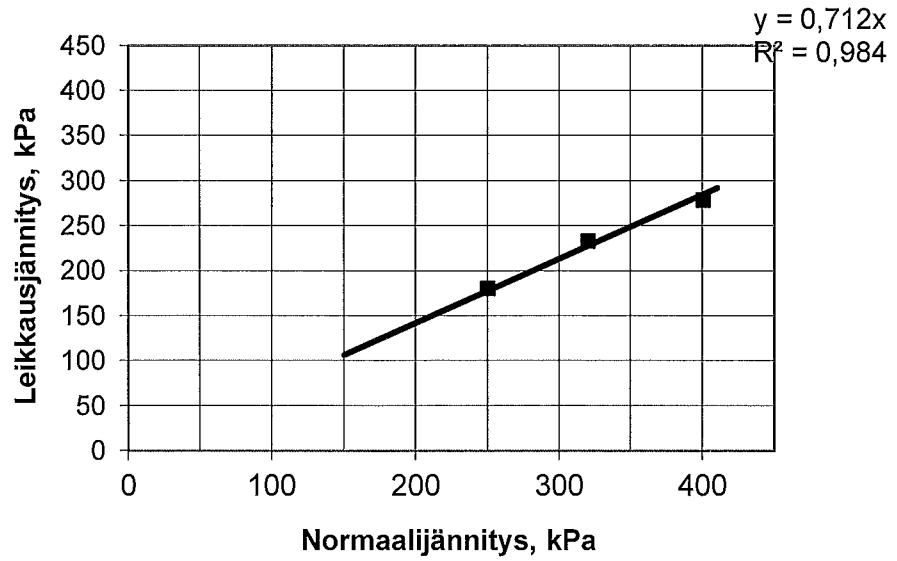
RASIALEIKKAUSKOE

Tampereen teknillinen yliopisto	ASIAKAS	VR Track Oy
Maa- ja pohjarakenteiden laitos	KOHDE	Unelius R571
PL 600 33101 TAMPERE	TYÖNUMERO	7/2014 (I7)

Suurin leikkausjännitys, koheesio pakotettu nollaksi
Kitkakulma φ = 40,2 astetta



Jäännöskitkakulma 3,9 mm (6,5 %) siirtymällä, koheesio pakotettu nollaksi:
Kitkakulma φ = 35,4 astetta



Tiedostot: I7_R6
I7_R7
I7_R8

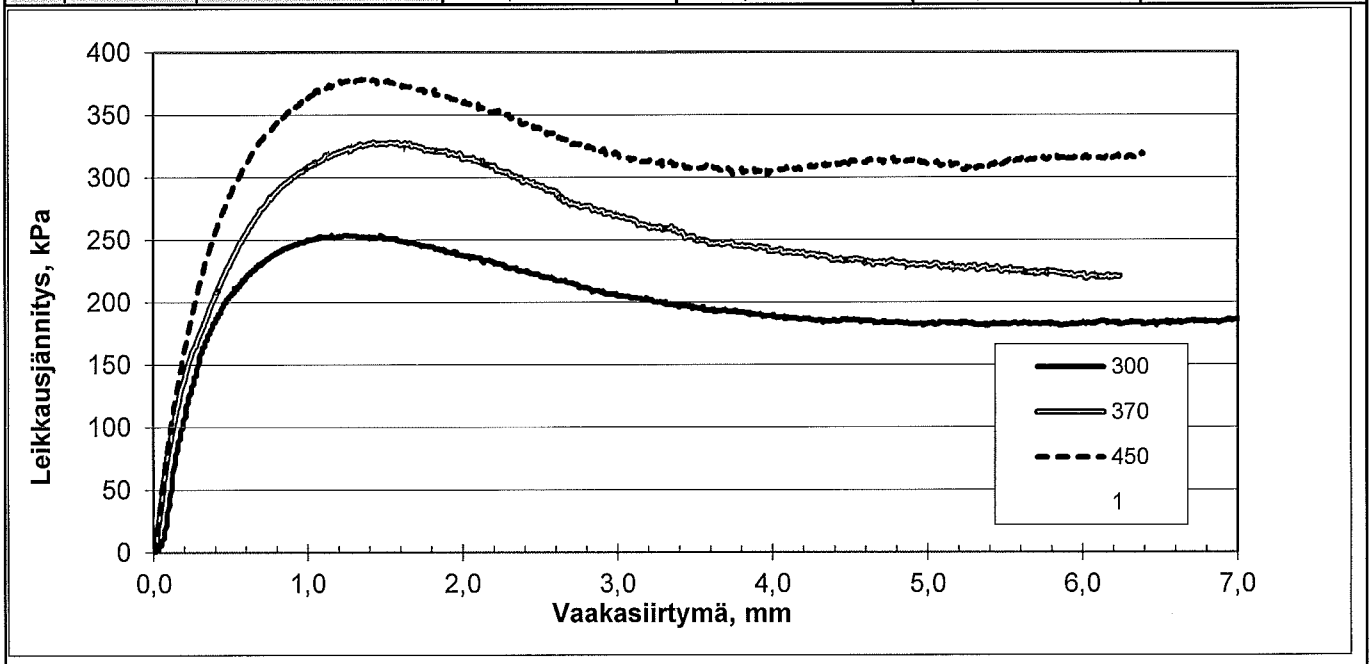
MPR 7/2014 Liite 3. 11 5

RASIALEIKKAUSKOE

Tampereen teknillinen yliopisto	**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteet	**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE	**TYÖNUMERO**	**7/2014 (I7)**

Päivämäärä: 22.1.14

Tilaajan työnumero/projektinumero:								
Piste, paalu:	**R571**							
Syvyys:	**52-53**							
Maalaji:	Hiekka		Hiekka		Hiekka		Hiekka	
Tiedosto:	I7_R1j		I7_R2		I7_R3			
Leikkausnopeus [mm/min]	0,015		0,015		0,015			
Normaalijännitys [kPa]	300		370		450			
Koenumero	**1**	w	**2**	w	**3**	w	**4**	w
Alkupaino ja vesipitoisuus [g]	233,1	16,4 %	230,8	16,3 %	227,8	16,3 %		
[g]								
Paino kuivana [g]	200,31		198,48		196,79			
Näytteen korkeus [mm]	30,57		30,05		29,34			
Alkutilavuus [cm3]	110,05		108,18		105,62			
Tilavuuspaino	20,8 kN/m3		20,9 kN/m3		21,2 kN/m3			kN/m3
Kuivatilavuuspaino	17,9 kN/m3		18,0 kN/m3		18,3 kN/m3			kN/m3
Alkukokoonpurist [mm]	0,55		0,29		0,39			
Kuivatilavuuspaino konsolid.	18,2 kN/m3		18,2 kN/m3		18,5 kN/m3			kN/m3
Vesipitoisuus lopussa	18,3 %		18,4 %		18,2 %			



3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

HUOM: Näytteet tiivistetty tiiviiksi. Tiivistyksessä pinnalle erottunut hieman vettä. Rasialeikkauslaatikko täytetty vedellä. Odotettu hetken aikaa ja konsolidoitu.

TUTKI: TAMPERE 6.3.2014 Niko Levo
PAIKKA PÄIVÄYS Laboratoriomestari

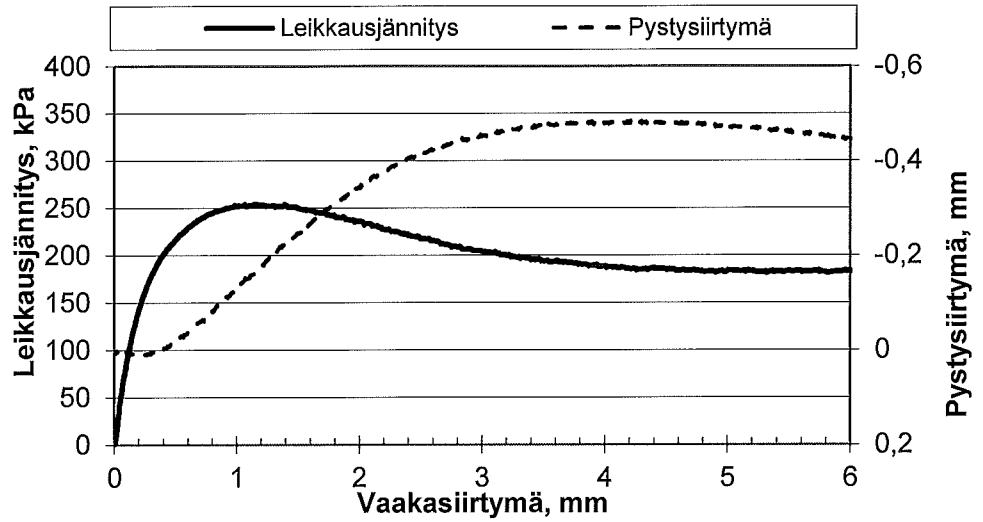
TARKASTI: TAMPERE 6.3.2014 NUUTTI VUORIMIES
PAIKKA PÄIVÄYS Projektipäällikkö, DI

MPR 7/2014 Liite 3. 2/5

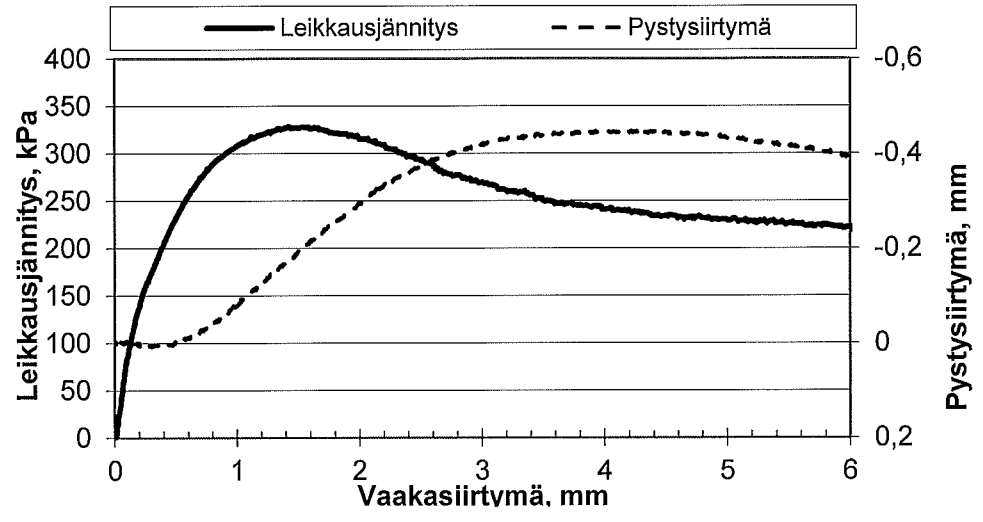
RASIALEIKKAUSKOE

Tampereen teknillinen yliopisto	**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteet	**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE	**TYÖNUMERO**	**7/2014 (I7)**

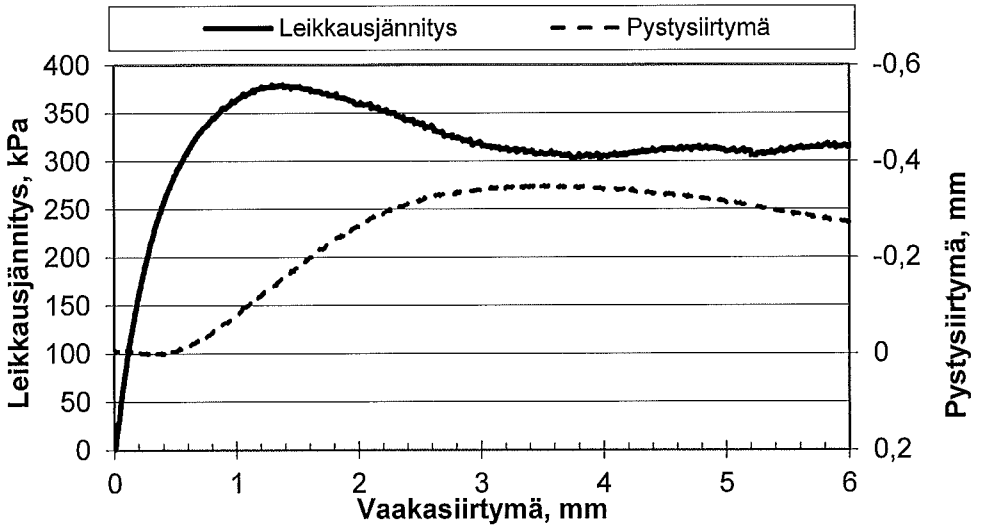
I7_R1j



I7_R2



I7_R3



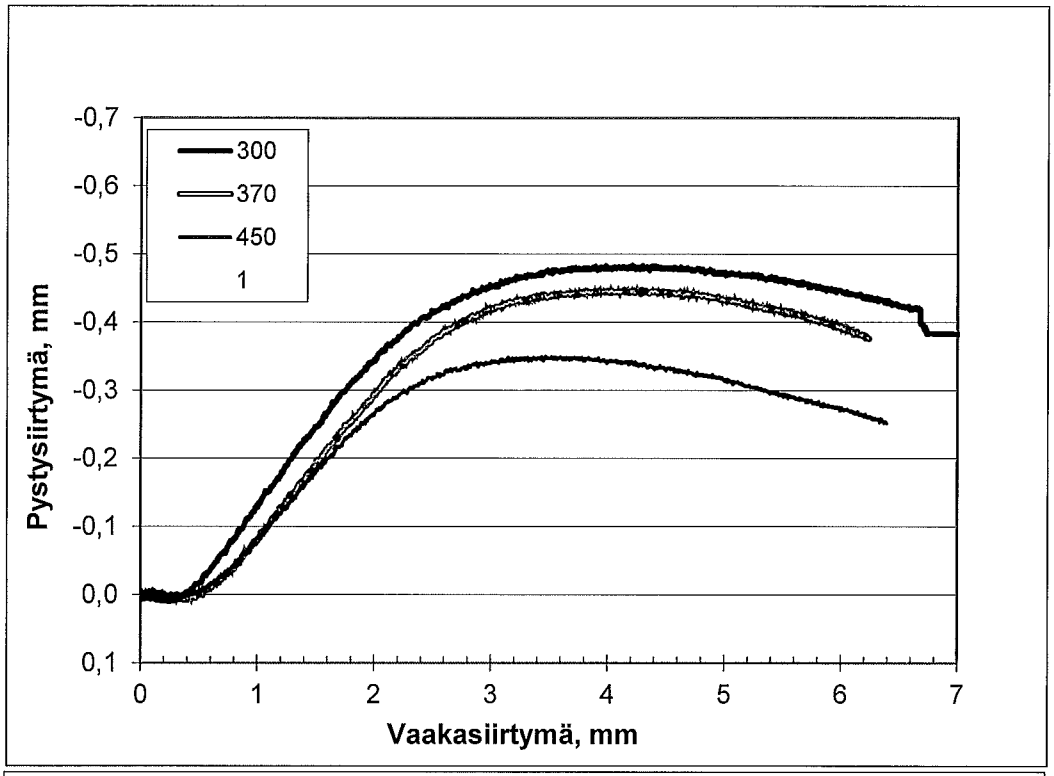
3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

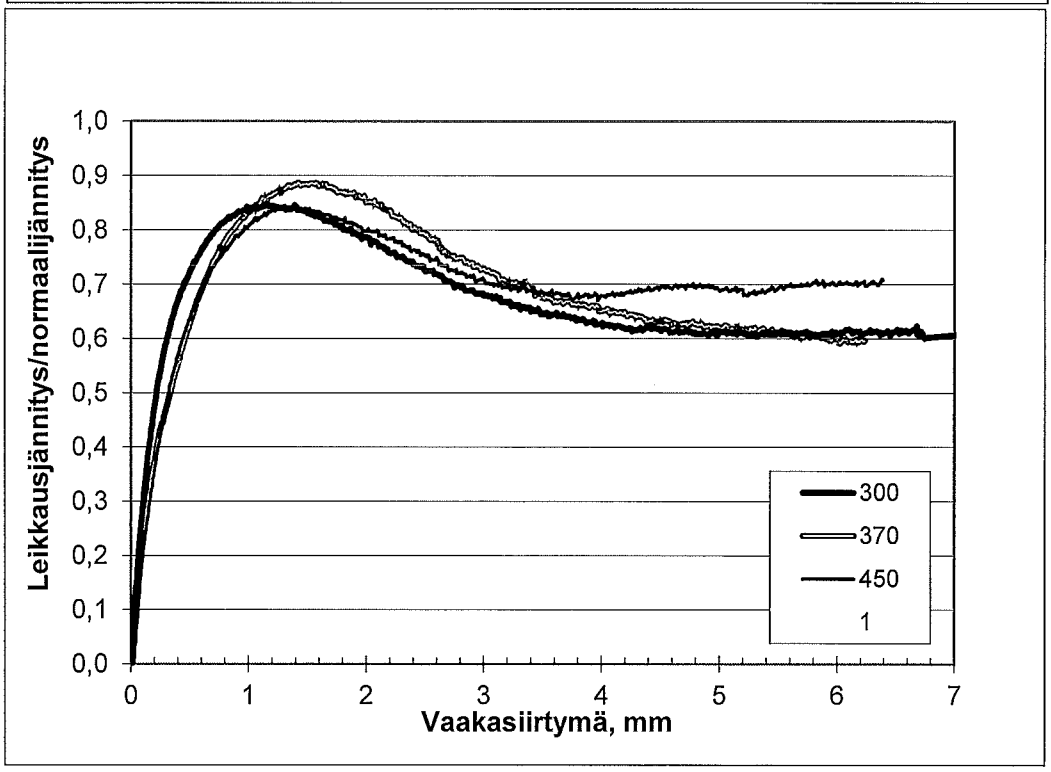
MPR 7/2014 Liite 3. 3 / 5

RASIALEIKKAUSKOE

Tampereen teknillinen yliopisto		**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteet		**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE		**TYÖNUMERO**	**7/2014 (I7)**

Hiekka piste: **R571** syvyys: **52-53** m





3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

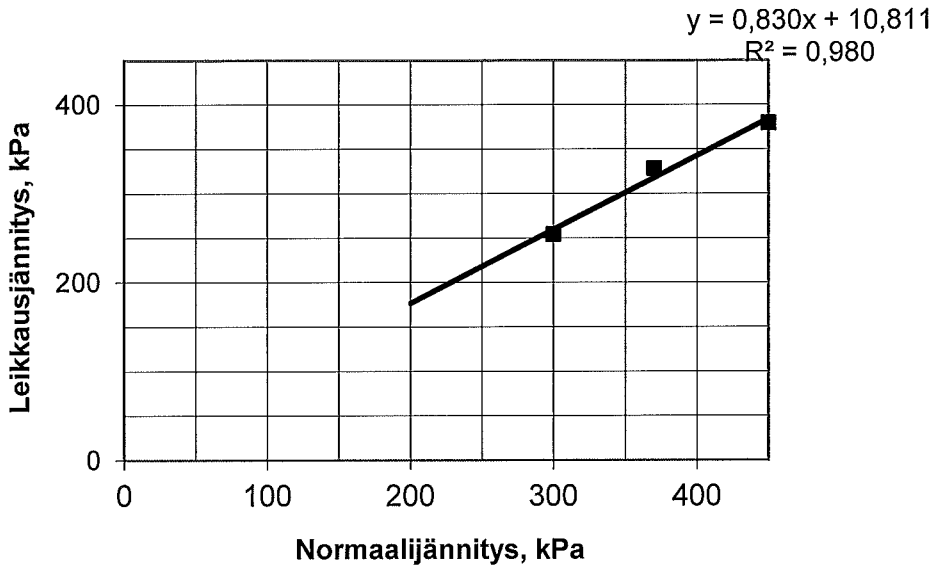
Tiedostot: I7_R1j
I7_R2
I7_R3

RASIALEIKKAUSKOE

Tampereen teknillinen yliopisto	**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteet	**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE	**TYÖNUMERO**	**7/2014 (I7)**

Hiekka piste: **R571** syvyys: **52-53**

Suurimmalla leikkausjännityksillä
Kitkakulma φ = 39,6 astetta ja koheesio c= 10,8 kPa



3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

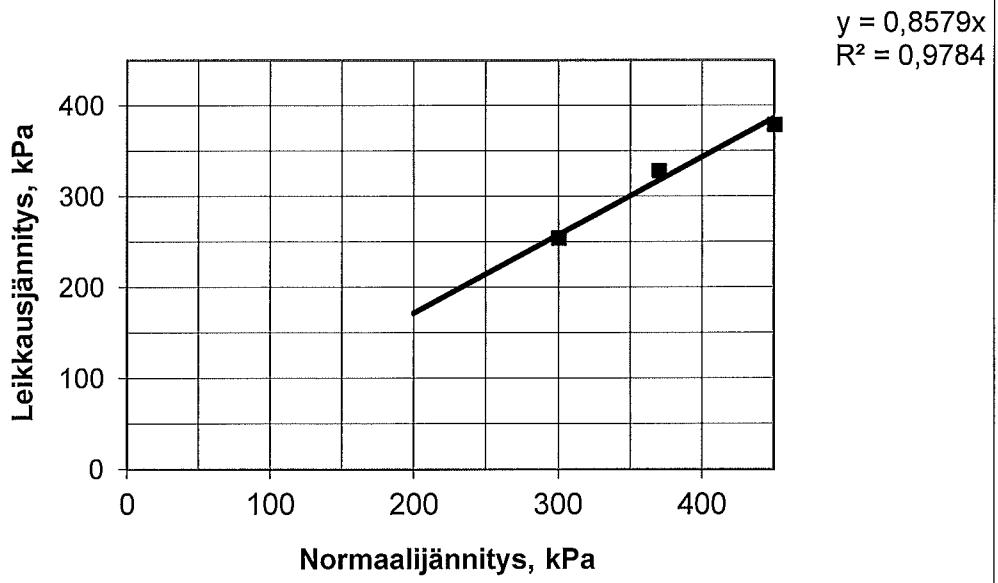
Tiedostot:	I7_R1j
	I7_R2
	I7_R3

MPR 7/2014 Liite 3. 5/5

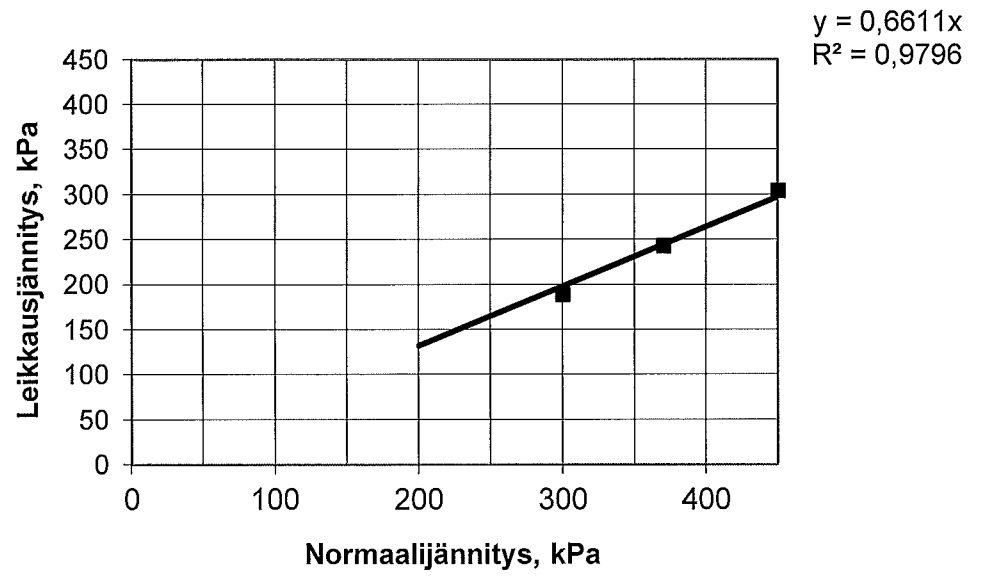
RASIALEIKKAUSKOE

Tampereen teknillinen yliopisto	**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteiden laitos	**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE	**TYÖNUMERO**	**7/2014 (I7)**

Suurin leikkausjännitys, koheesio pakotettu nollaksi
Kitkakulma φ = 40,6 astetta



Jäännöskitkakulma 3,9 mm (6,5 %) siirtymällä, koheesio pakotettu nollaksi:
Kitkakulma φ = 33,4 astetta



Tiedostot: I7_R1j
I7_R2
I7_R3

0

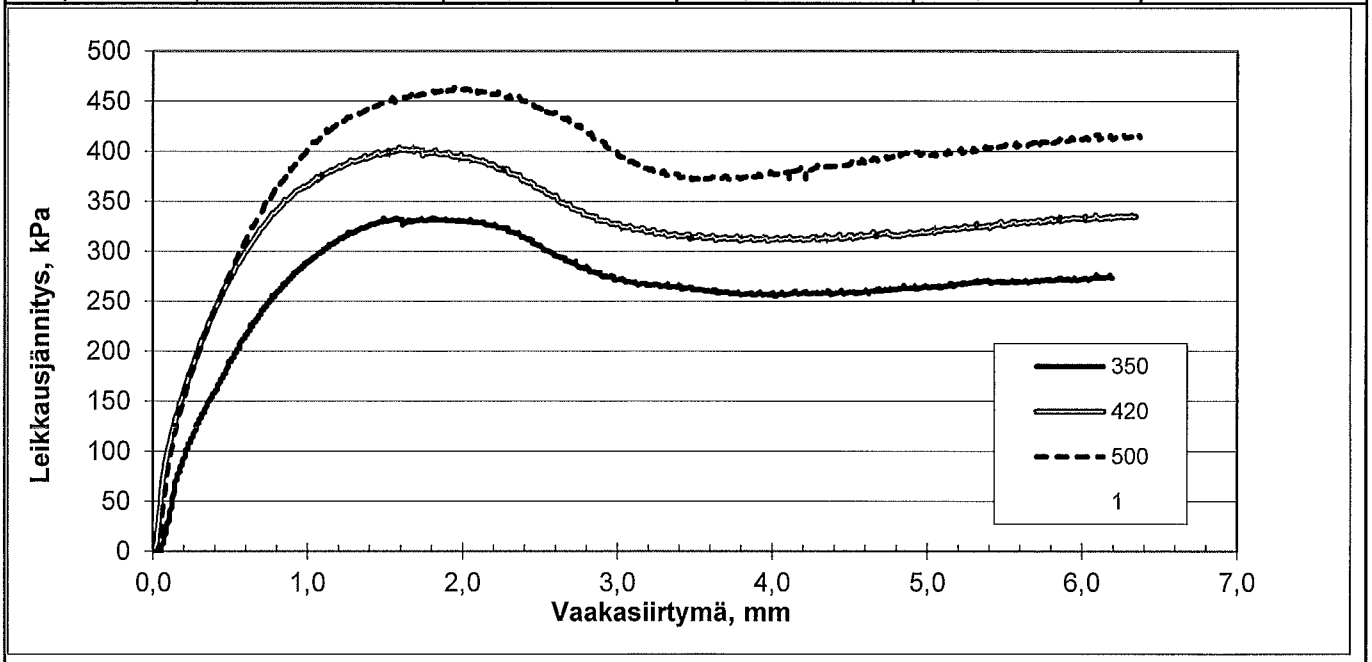
MPR 7/2014 Liite 4. 1/5

RASIALEIKKAUSKOE

Tampereen teknillinen yliopisto	**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteet	**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE	**TYÖNUMERO**	**7/2014 (I7)**

Päivämäärä: 6. - 11.2.2014

Tilaajan työnumero/projektinumero:									
Piste, paalu:		**R571**							
Syvyys:		**62 - 63 m**							
Maalaji:		Hiekka, yli 4 mm rakeet poistettu							
Tiedosto:		I7_R16		I7_R17		I7_R18			
Leikkausnopeus	[mm/min]	0,015		0,015		0,015			
Normaalijännitys	[kPa]	350		420		500			
Koenumero		**1**	w	**2**	w	**3**	w	**4**	w
Alkupaino ja vesipitoisuus	[g]	255,5	11,8 %	255,1	12,1 %	254,5	12,1 %		
	[g]								
Paino kuivana	[g]	228,45		227,61		229,30			
Näytteen korkeus	[mm]	30,78		30,54		30,30			
Alkutilavuus	[cm3]	110,81		109,94		109,08			
Tilavuuspaino		22,6	kN/m3	22,8	kN/m3	22,9	kN/m3		kN/m3
Kuivatilavuuspaino		20,2	kN/m3	20,3	kN/m3	20,6	kN/m3		kN/m3
Alkukokoonpurist	[mm]	0,34		0,42		0,40			
Kuivatilavuuspaino konsolid.		20,5	kN/m3	20,6	kN/m3	20,9	kN/m3		kN/m3
Vesipitoisuus lopussa		13,2 %		13,3 %		13,9 %			



3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

HUOM: Näytteet tiivistetty tiiviiksi. Tiivistyksessä pinnalle erottunut hieman vettä. Rasialeikkauslaatikko täytetty vedellä. Odotettu hetken aikaa ja konsolidoitu.

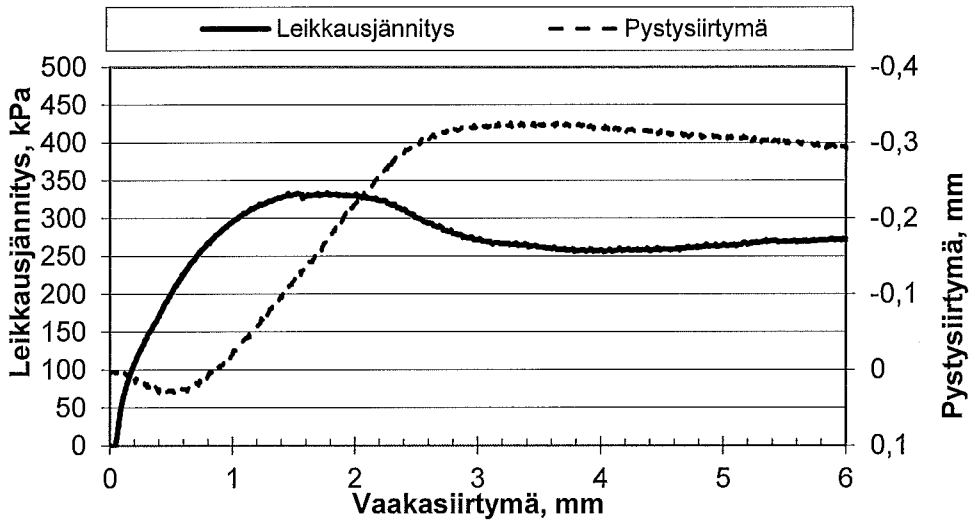
TUTKI: TAMPERE 6.3.2014 Niko Levo
PAIKKA PÄIVÄYS Laboratoriomestari

TARKASTI: TAMPERE 6.3.2014 NUUTTI VUORIMIES
PAIKKA PÄIVÄYS Projektipäällikkö, DI

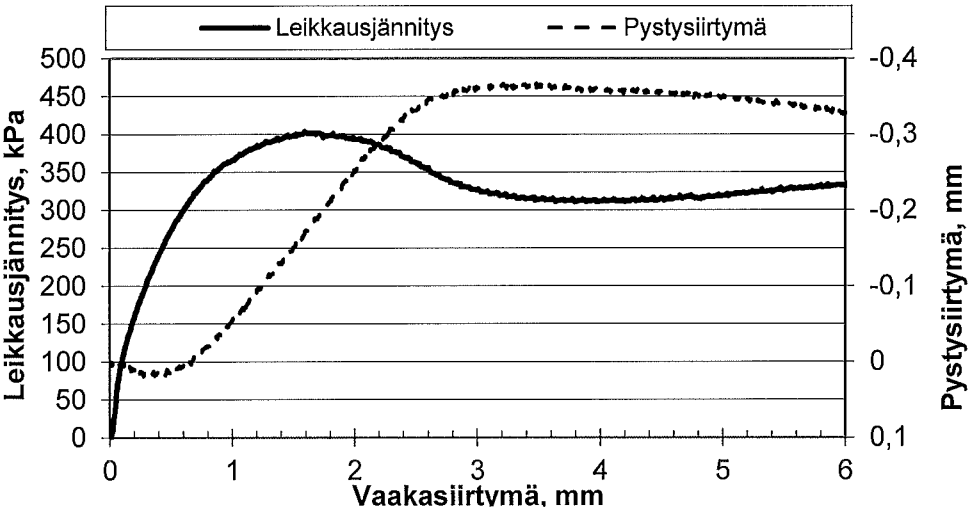
RASIALEIKKAUSKOE

Tampereen teknillinen yliopisto	**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteet	**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE	**TYÖNUMERO**	**7/2014 (I7)**

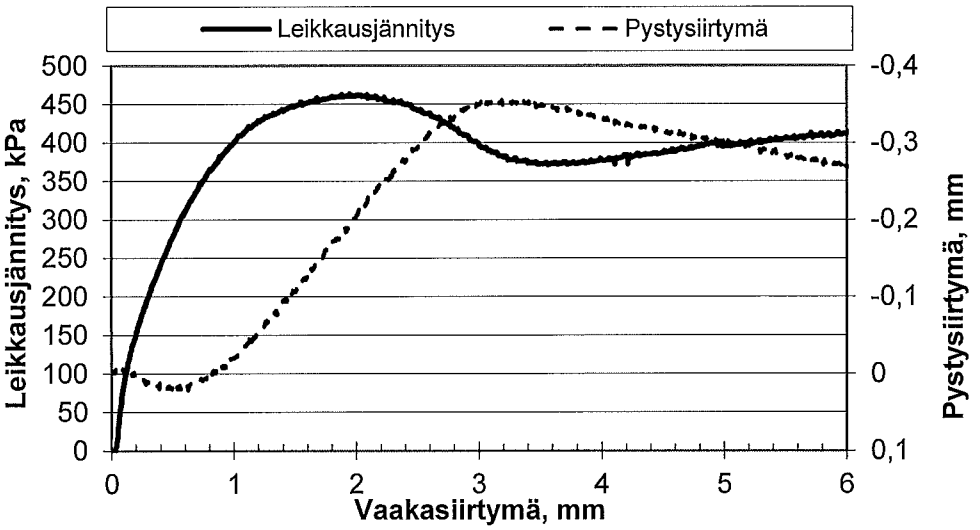
I7_R16



I7_R17



I7_R18



3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

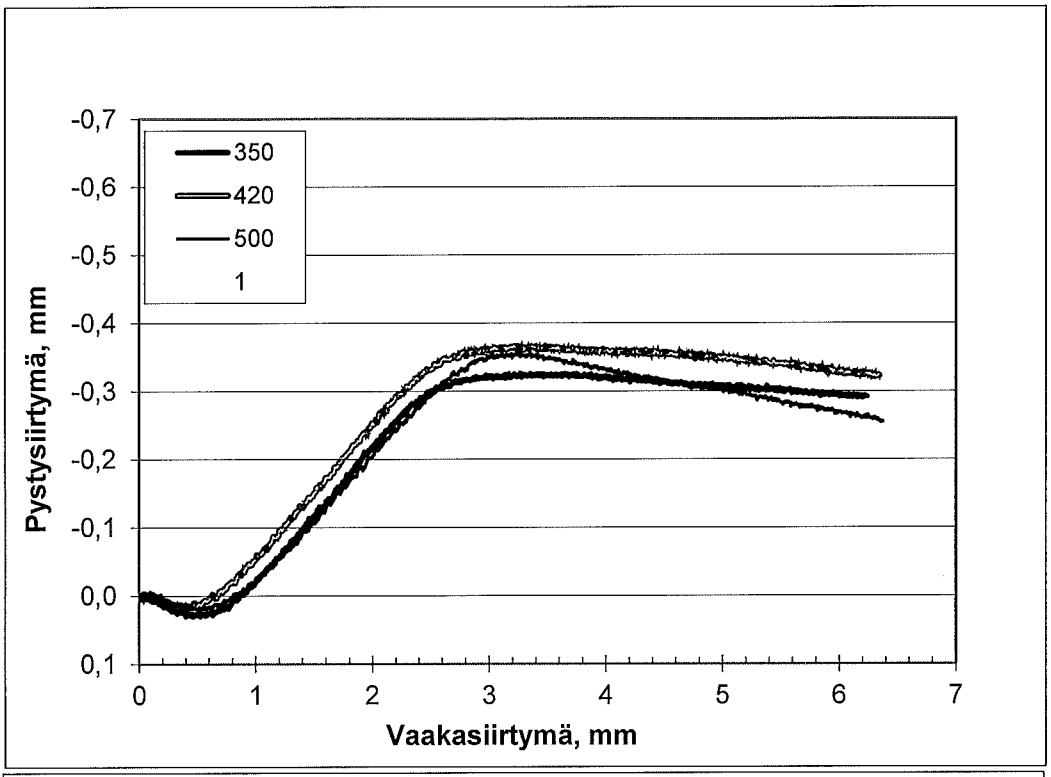
MPR 7/2014 Liite 4. 3/5

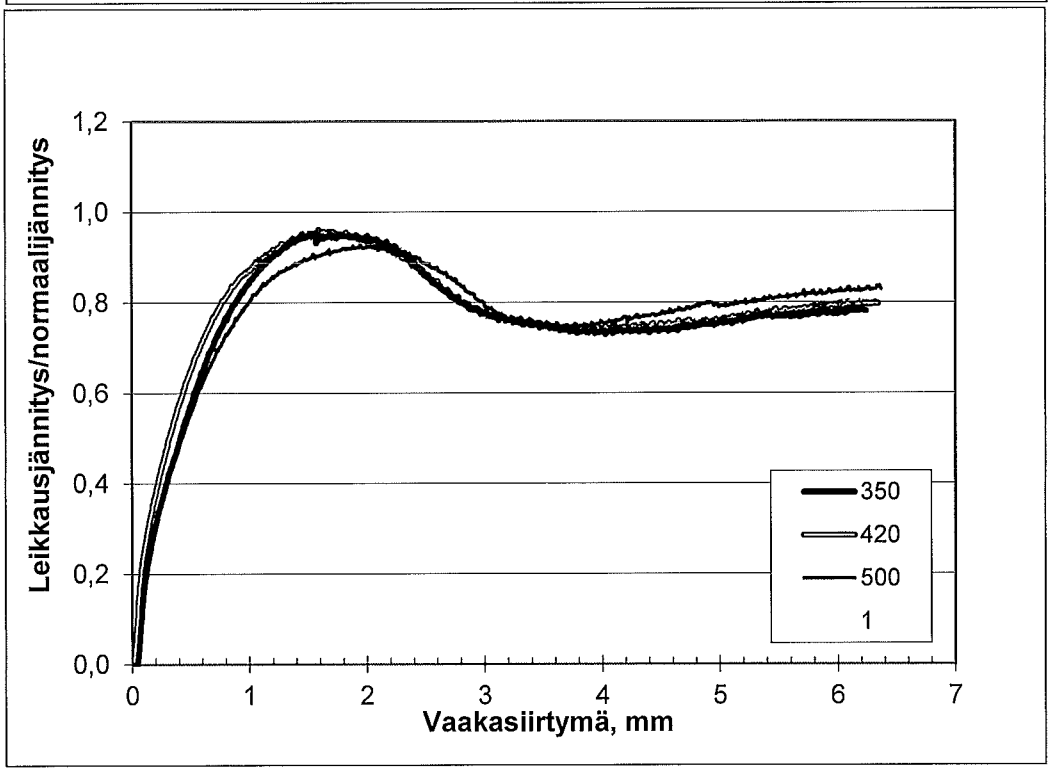
RASIALEIKKAUSKOE

Tampereen teknillinen yliopisto	**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteet	**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE	**TYÖNUMERO**	**7/2014 (I7)**

piste:

Hiekka, yli 4 mm rakeet poistettu **R571** syvyys: **62 - 63 m** m





3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

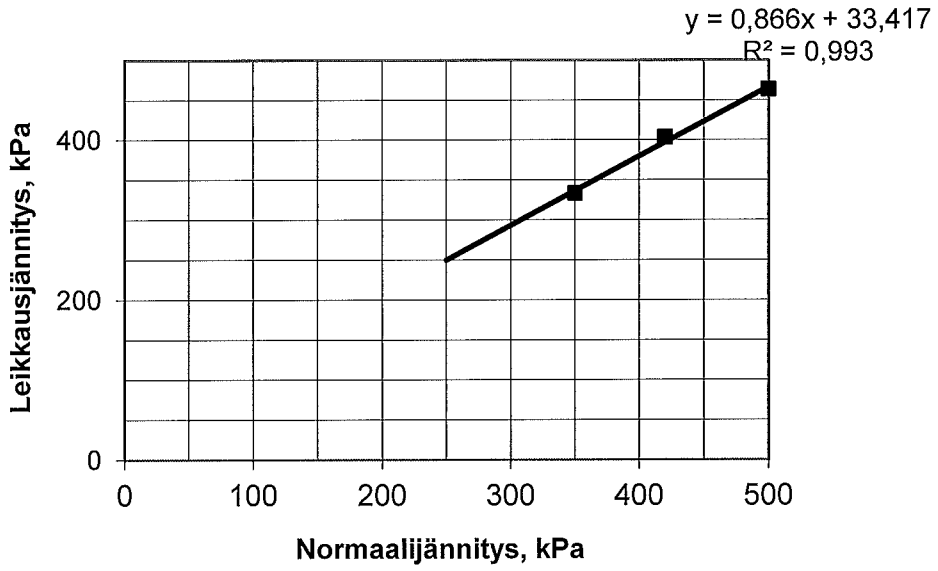
Tiedostot: I7_R16
I7_R17
I7_R18

RASIALEIKKAUSKOE

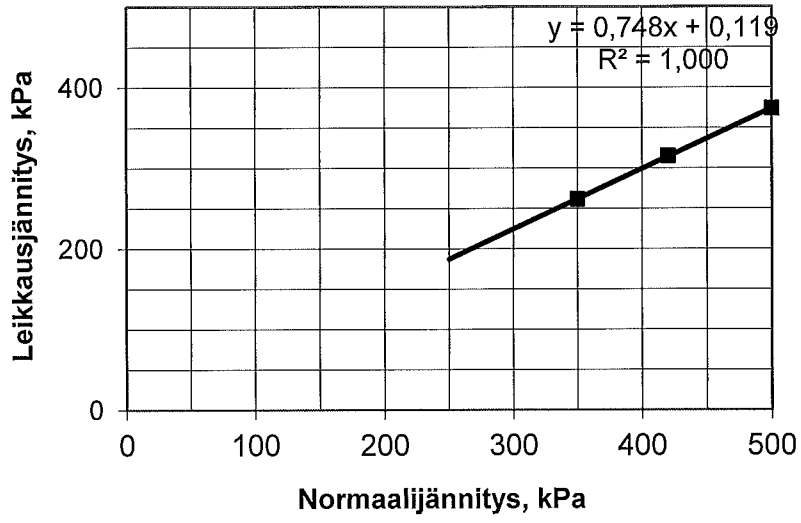
Tampereen teknillinen yliopisto	**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteet	**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE	**TYÖNUMERO**	**7/2014 (I7)**

Hiekka, yli 4 mm rakeet poistettu piste: **R571** syvyys: **62 - 63 m**

Suurimmalla leikkausjännityksillä
Kitkakulma φ = 40,9 astetta ja koheesio c= 33,4 kPa



Leikkausmuodonmuutos 6,0 % (3.6 mm)
Kitkakulma φ = 36,8 astetta ja koheesio c = 0,1 kPa



3 mm on 5 % vaakasiirtymä ja 1.2 mm on 2 % vaakasiirtymä

Tiedostot: I7_R16
I7_R17
I7_R18

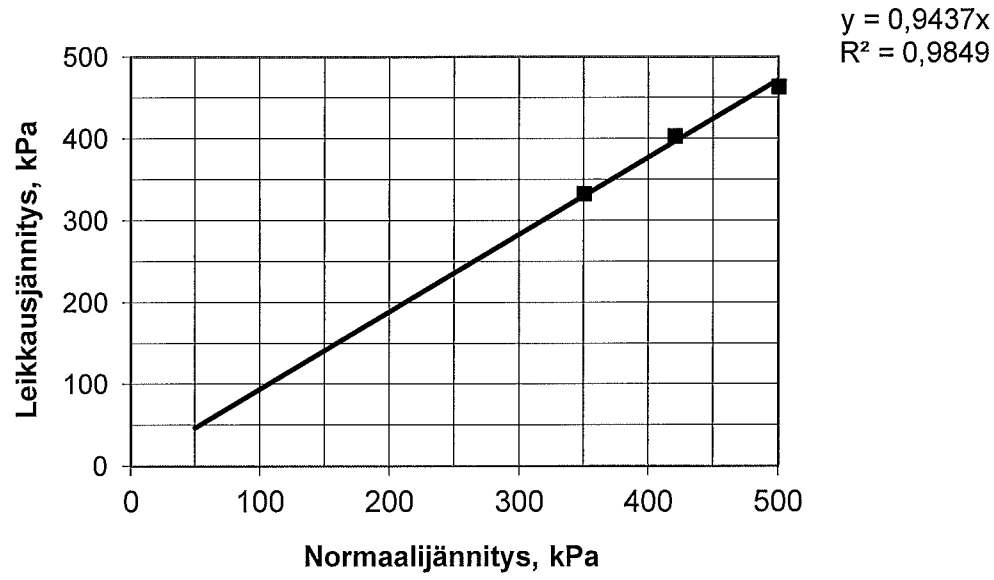
MPR 7/2014 Liite 4. 5/5

RASIALEIKKAUSKOE

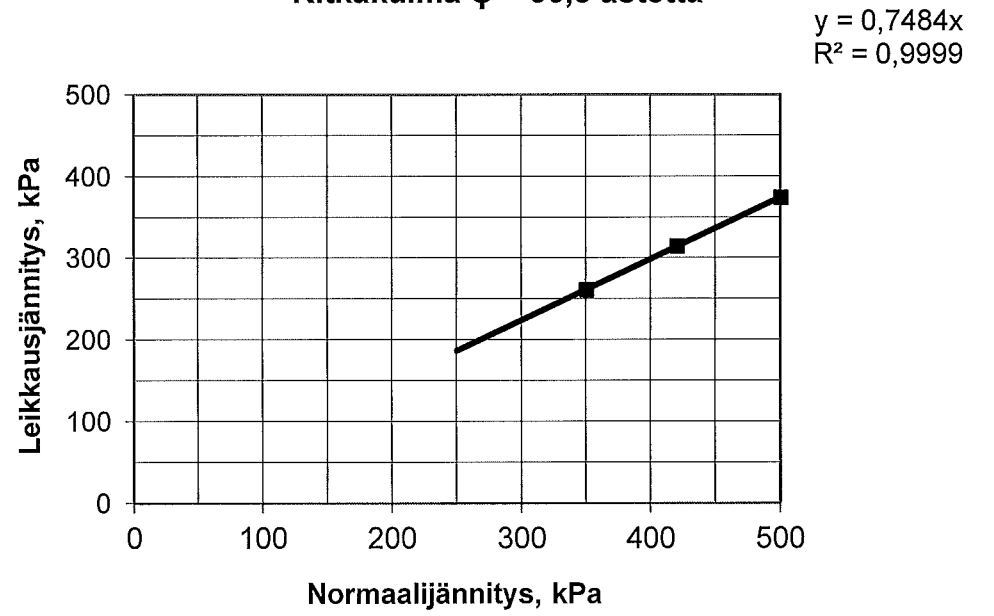
Tampereen teknillinen yliopisto	**ASIAKAS**	**VR Track Oy**
Maa- ja pohjarakenteiden laitos	**KOHDE**	**Unelius R571**
PL 600 33101 TAMPERE	**TYÖNUMERO**	**7/2014 (I7)**

Hiekka, yli 4 mm rakeet poistettu piste: **R571** syvyys: **62 - 63 m**

Suurin leikkausjännitys, koheesio pakotettu nollaksi
Kitkakulma φ = 43,3 astetta

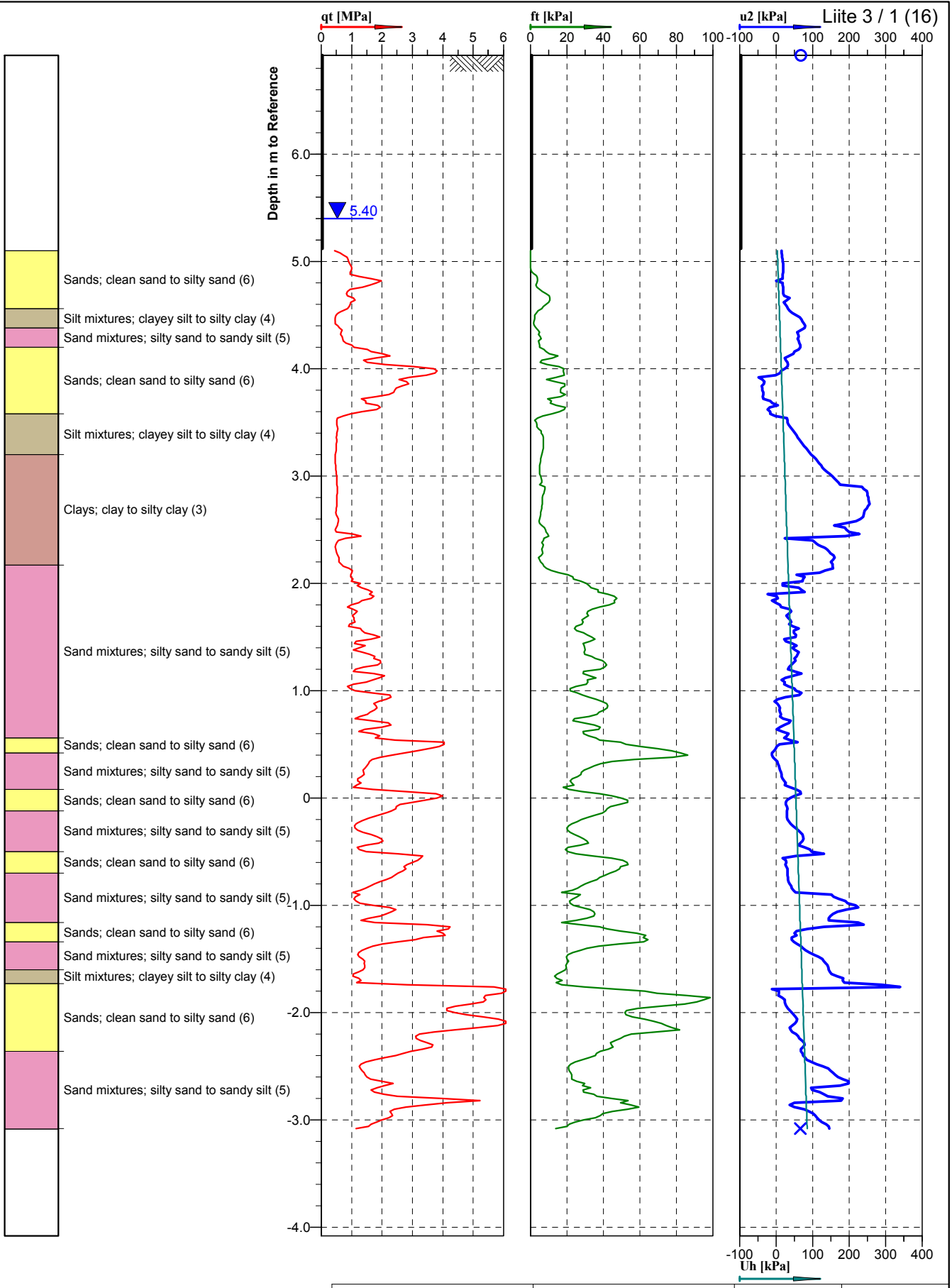


Jäännöskitkakulma 3,6 mm (6,0 %) siirtymällä, koheesio pakotettu nollaksi:
Kitkakulma φ = 36,8 astetta



Tiedostot: I7_R16
I7_R17
I7_R18

0

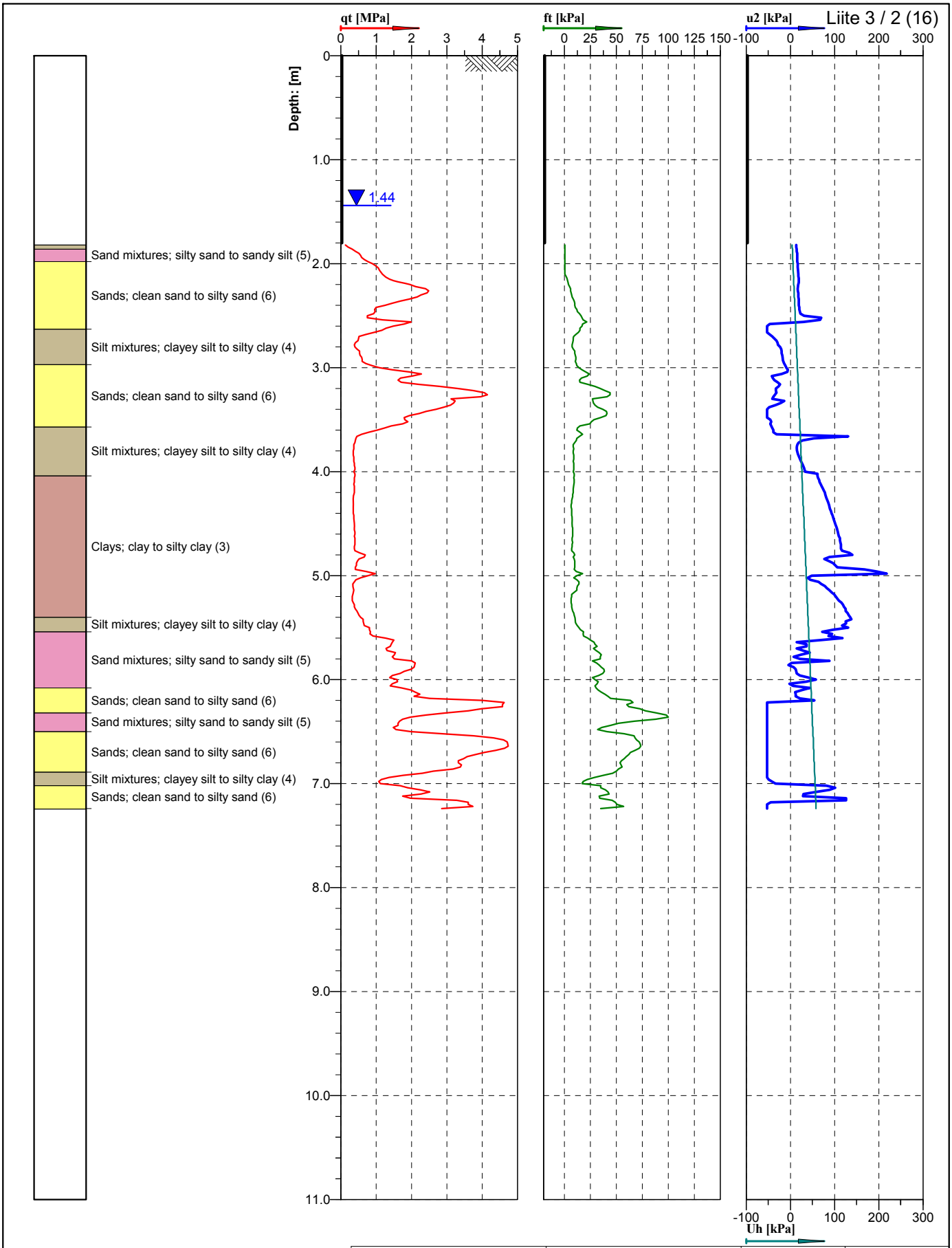


VR TRACK

U2

Cone No: 10 tn
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location:	Position: X: 7202499.405 m, Y: 26477054.616 m	Ground level: 6.92	Test No.: 1
Project ID: Zatelliitti	Client:	Date: 22102014	Scale: 1 : 50
Project:		Page: 1/1	Fig.:
		File: 1.cpd	

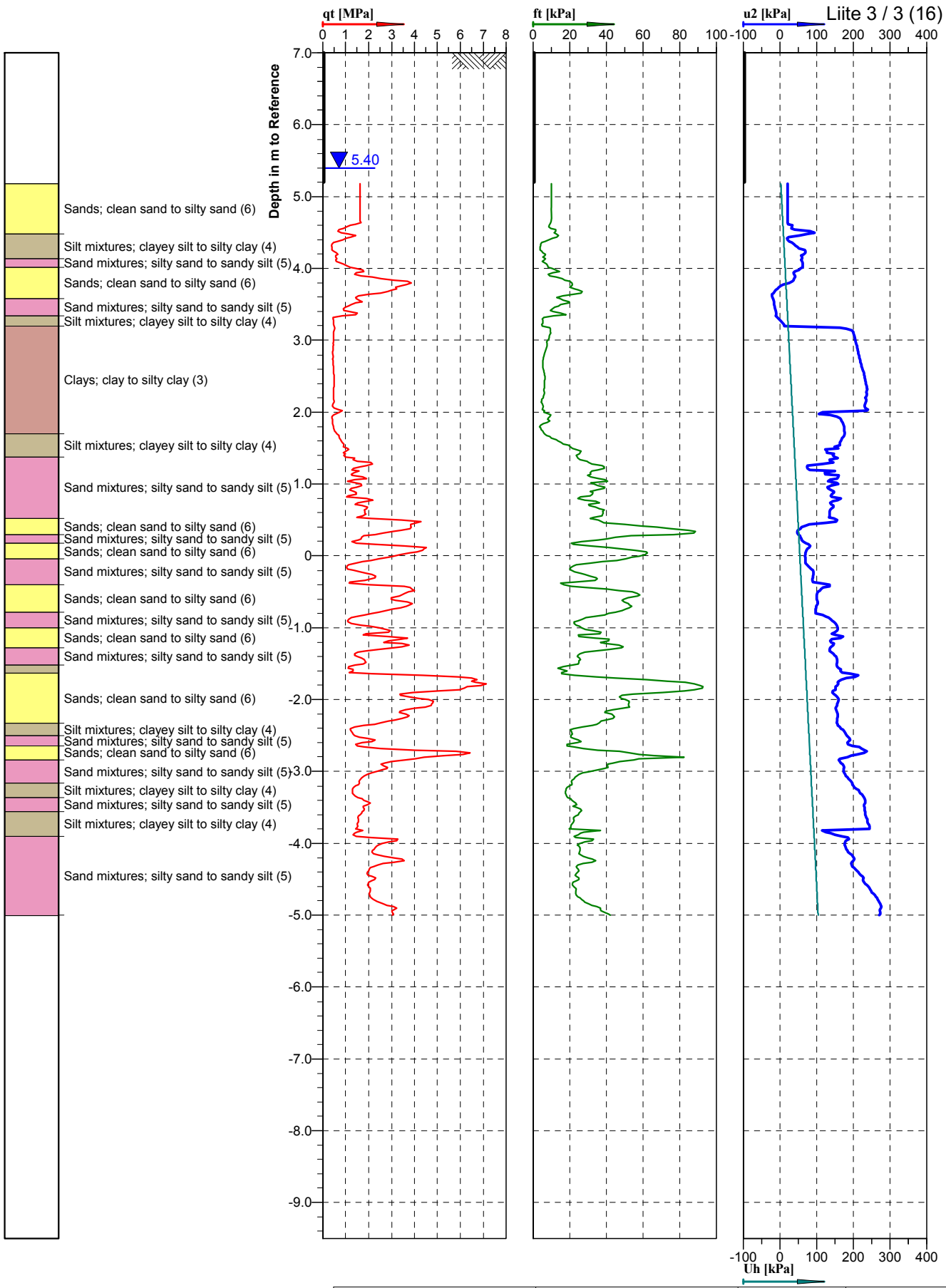


VR TRACK

U2

Cone No: 1 tn
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location:	Position: X: 7202496.652 m, Y: 26477074.272 m	Ground level: 6.84	Test No.: 3
Project ID: 7399	Client:	Date: 28102014	Scale: 1 : 50
Project: Zatelliitti		Page: 1/1	Fig.:
		File: 3.cpd	

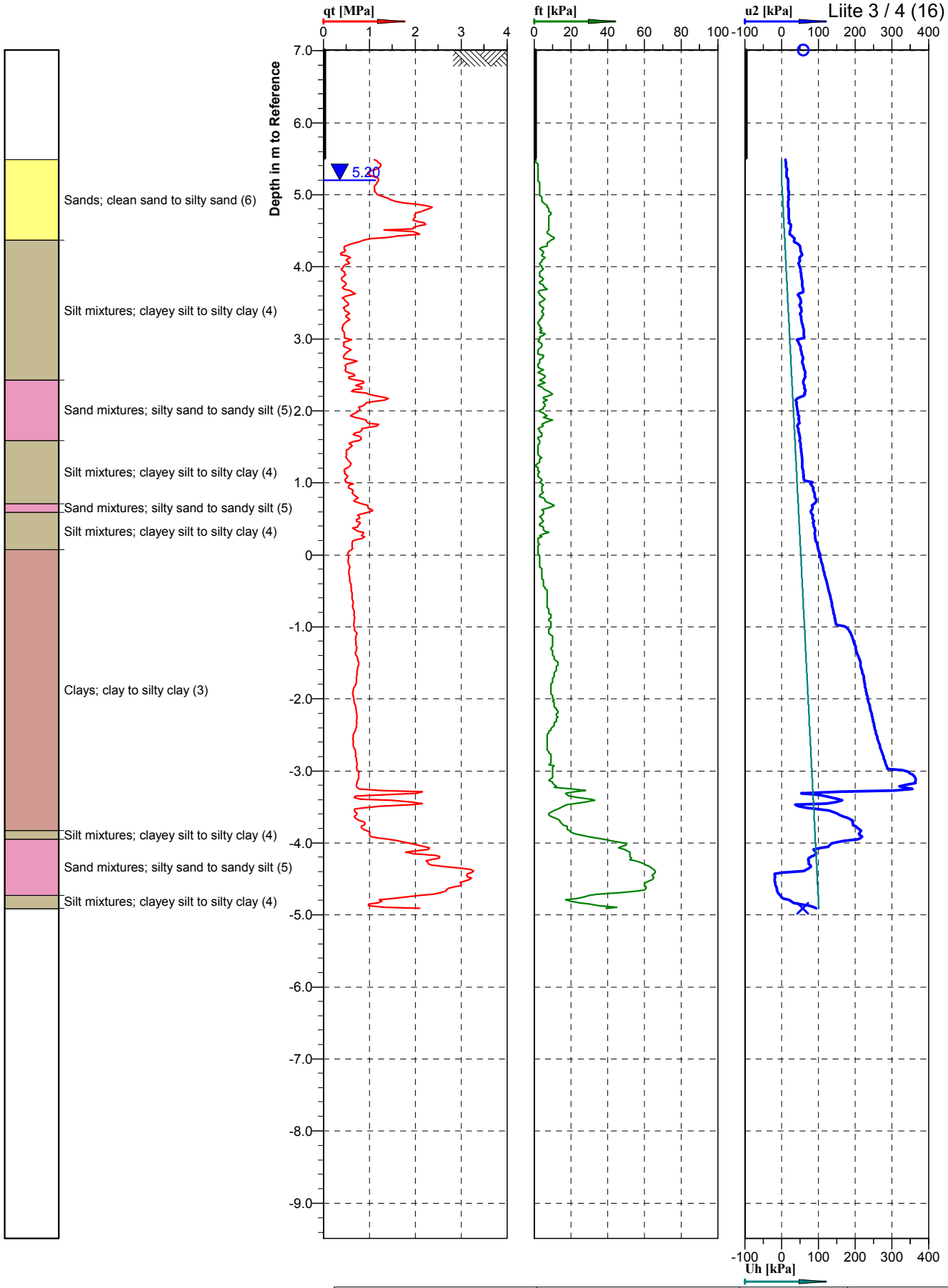


Location:	Position: X: 7202497.770 m, Y: 26477064.215 m 6.998	Ground level:	Test No.: 2
Project ID: Zatelliitti	Client:	Date: 28102014	Scale: 1 : 75
Project:		Page: 1/1	Fig.:
		File: 2.txt	

VR TRACK

U2

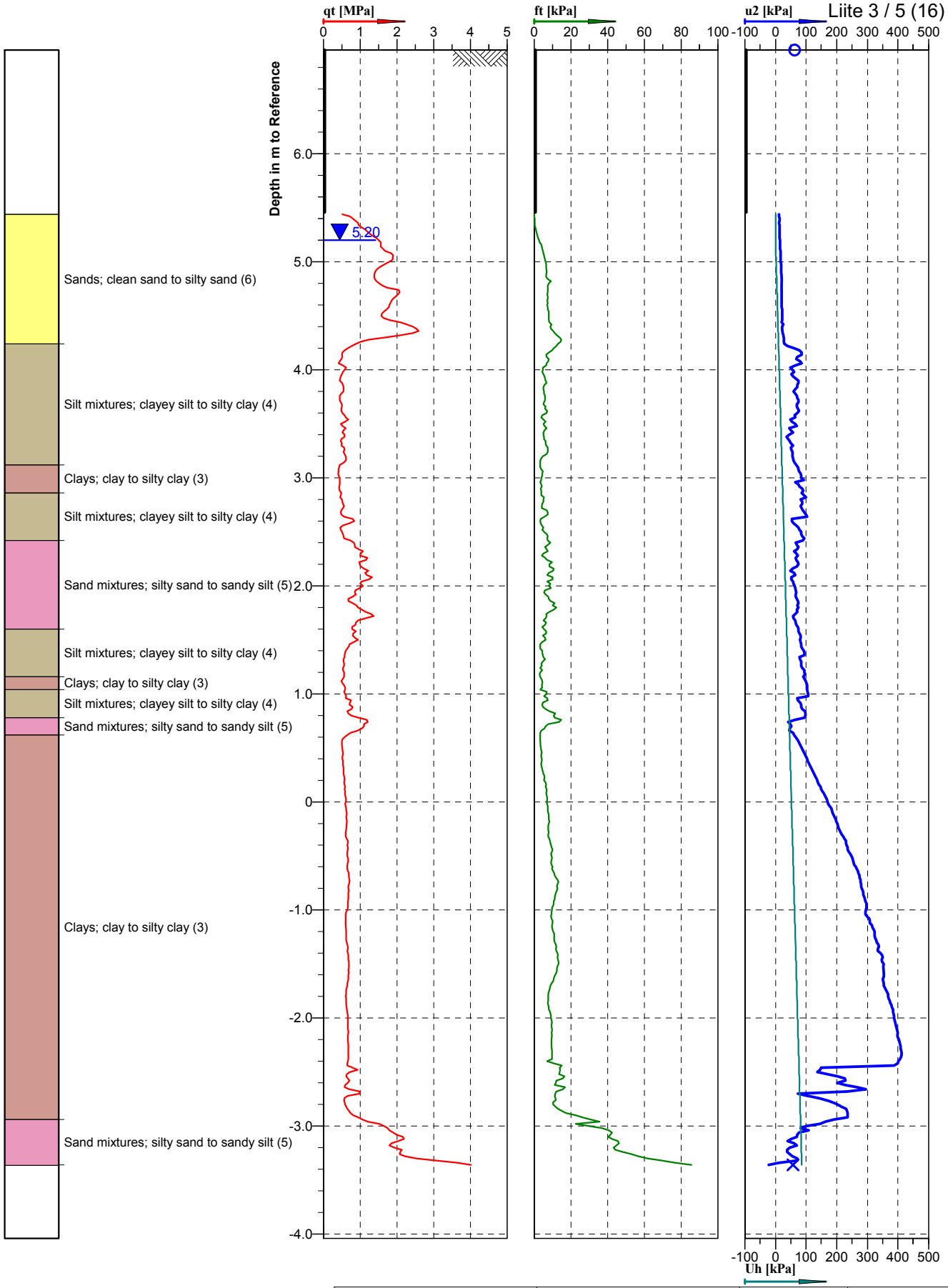
Cone No: 10 tn
Tip area [cm2]: 10
Sleeve area [cm2]: 150



U2

Cone No: 10 tn
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location:	Position: X: 7202477.845 m, Y: 26477223.002 m	Ground level: 7.009	Test No.: 16
Project ID: Zatelliitti	Client:	Date: 20102014	Scale: 1 : 75
Project:		Page: 1/1	Fig.:
		File: 16.cpd	

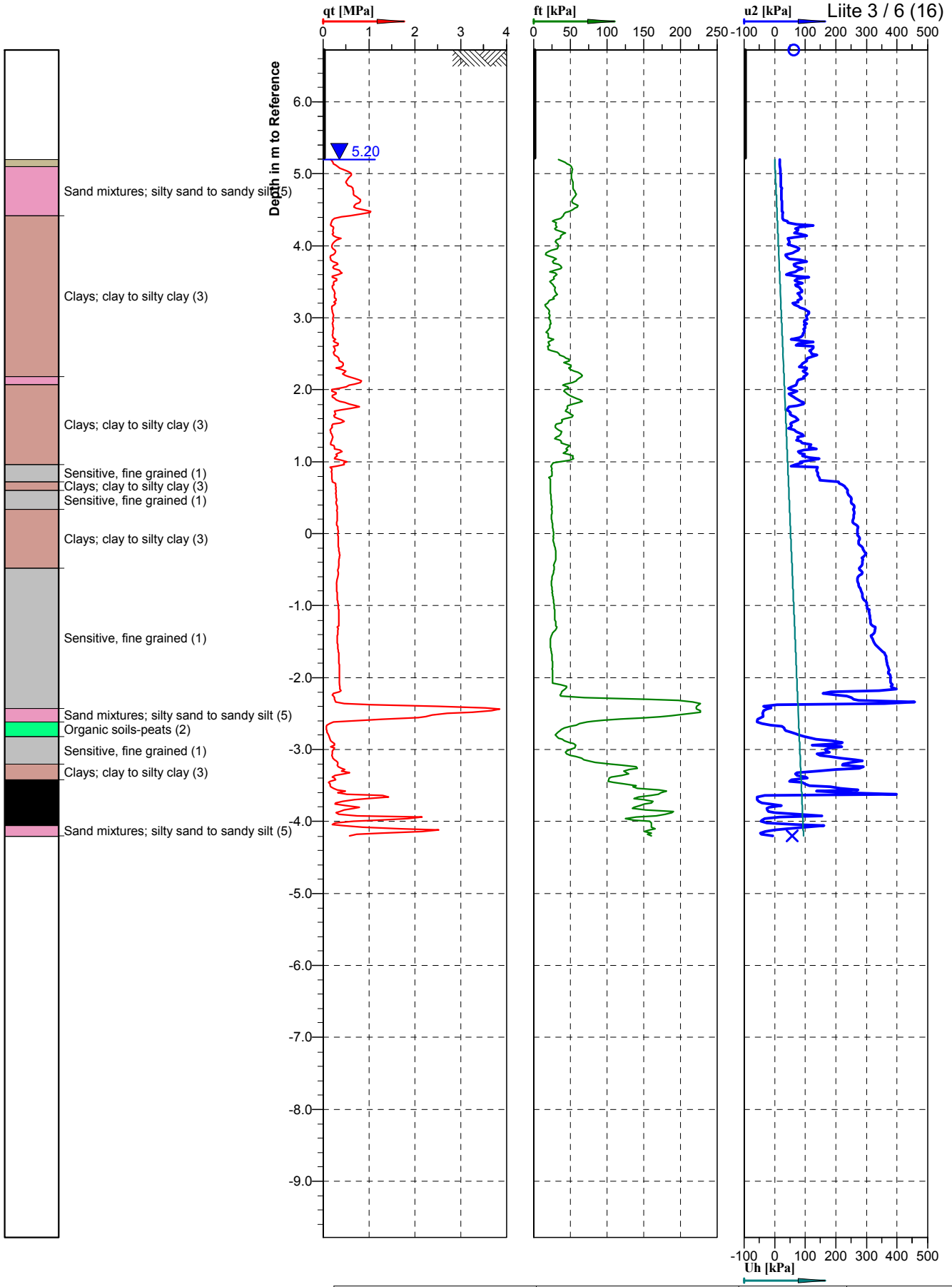


VR TRACK

U2

Cone No: 10 tn
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location:	Position: X: 7202479.137 m, Y: 26477213.207 m	Ground level: 6.96	Test No.: 15
Project ID: Zatelliitti	Client:	Date: 20102014	Scale: 1 : 50
Project:		Page: 1/1	Fig.:
		File: 15.cpd	

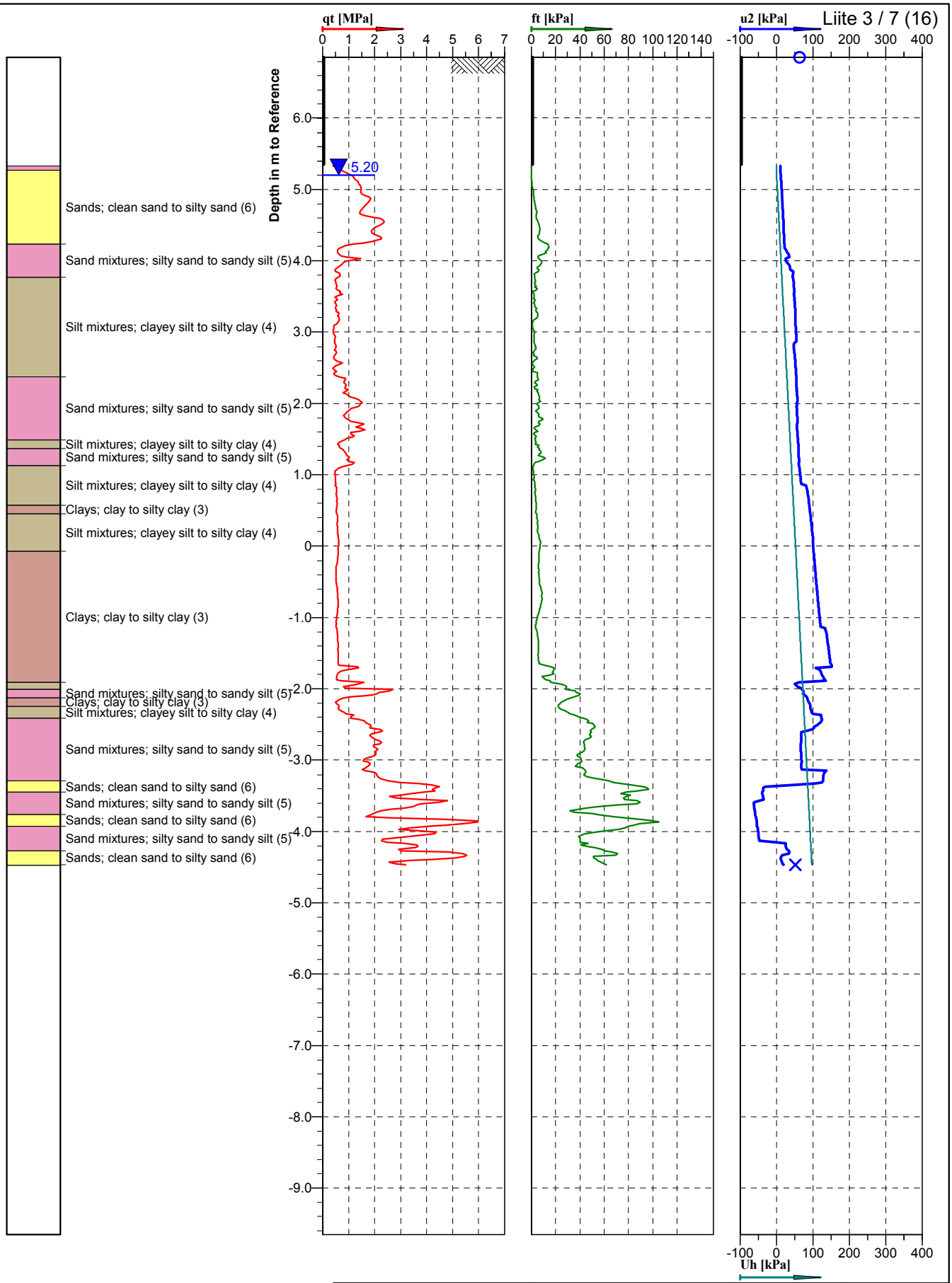


Location:	Position: X: 7202480.303 m, Y: 26477203.052 m	Ground level: 6.720	Test No.: 14
Project ID: Zatelliitti	Client:	Date: 20102014	Scale: 1 : 75
Project:		Page: 1/1	Fig.:
		File: 14.cpd	

VR TRACK

U2

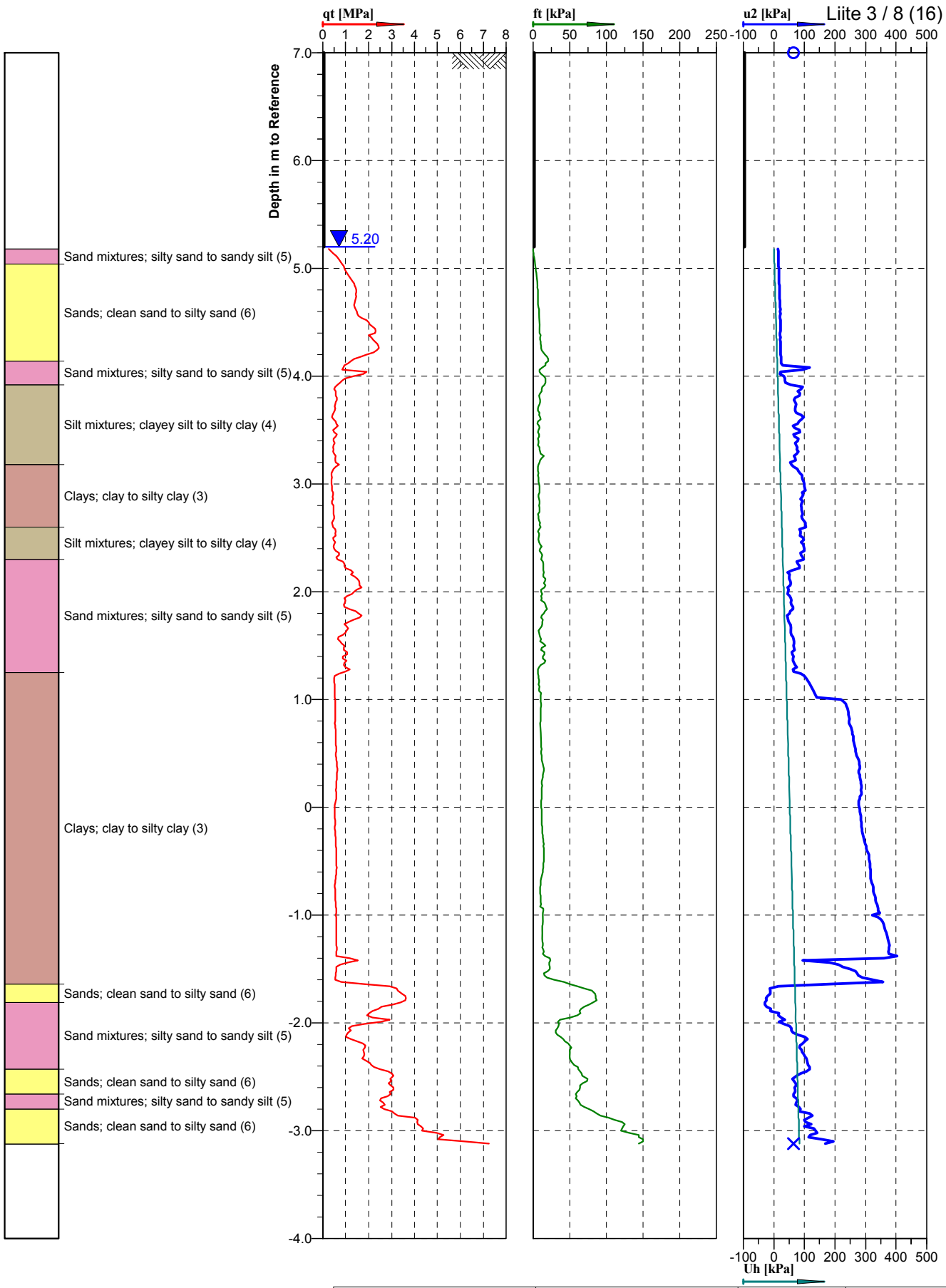
Cone No: 10 tn
Tip area [cm2]: 10
Sleeve area [cm2]: 150



U2

Cone No: 10 tn
Tip area [cm2]: 10
Sleeve area [cm2]: 150

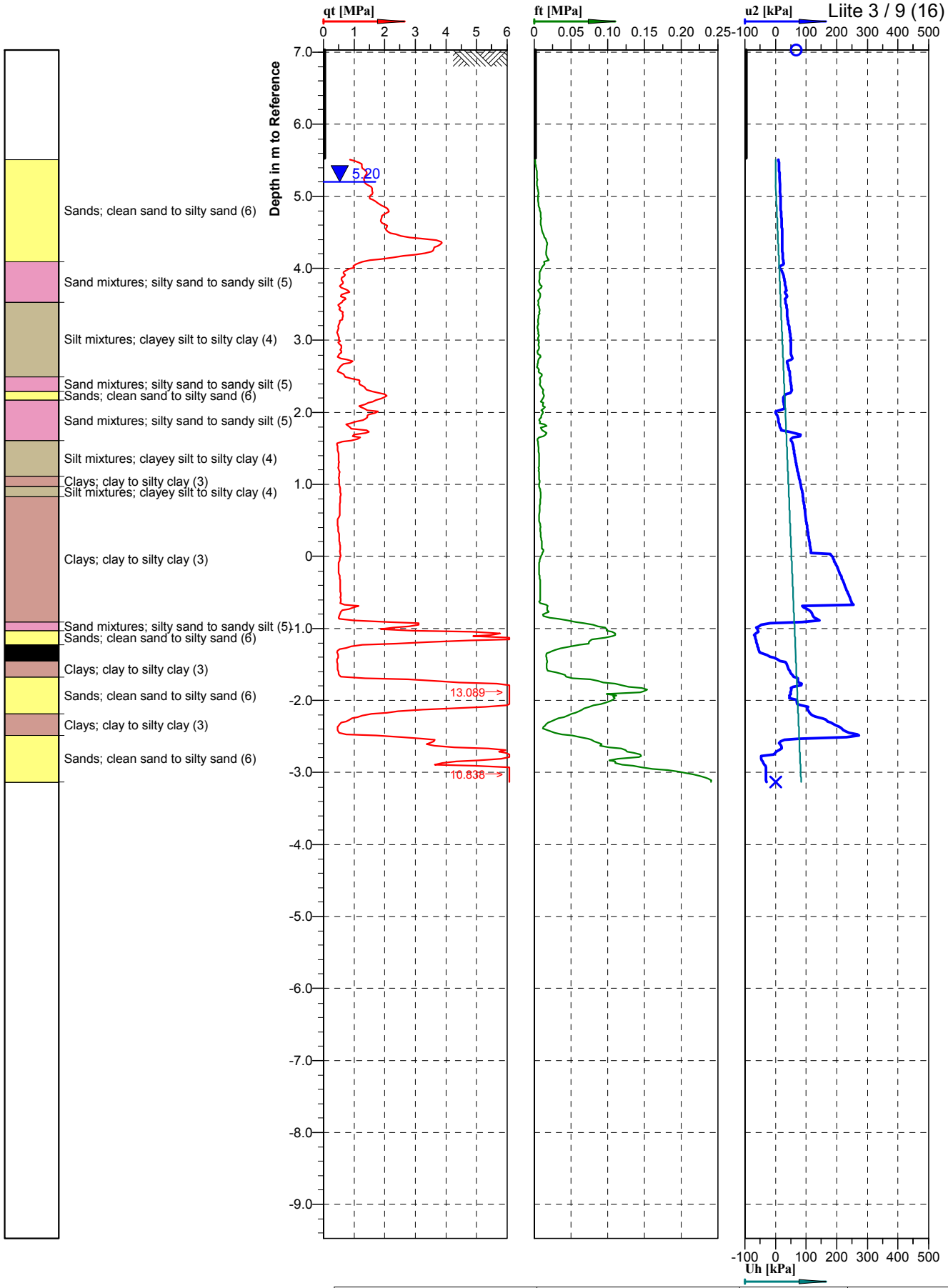
Location:	Position: X: -999999 m, Y: -999999 m	Ground level: 6.85	Test No.: 13
Project ID: 7399	Client:	Date: 20102014	Scale: 1 : 75
Project: ZATELLIITTI		Page: 1/1	Fig.:
		File: 13.cpd	



Location:	Position: X: -999999 m, Y: -999999 m	Ground level: 7.00	Test No.: 12
Project ID: 7399	Client:	Date: 21102014	Scale: 1 : 50
Project: ZATELLIITTI		Page: 1/1	Fig.:
		File: 12.txt	

U2

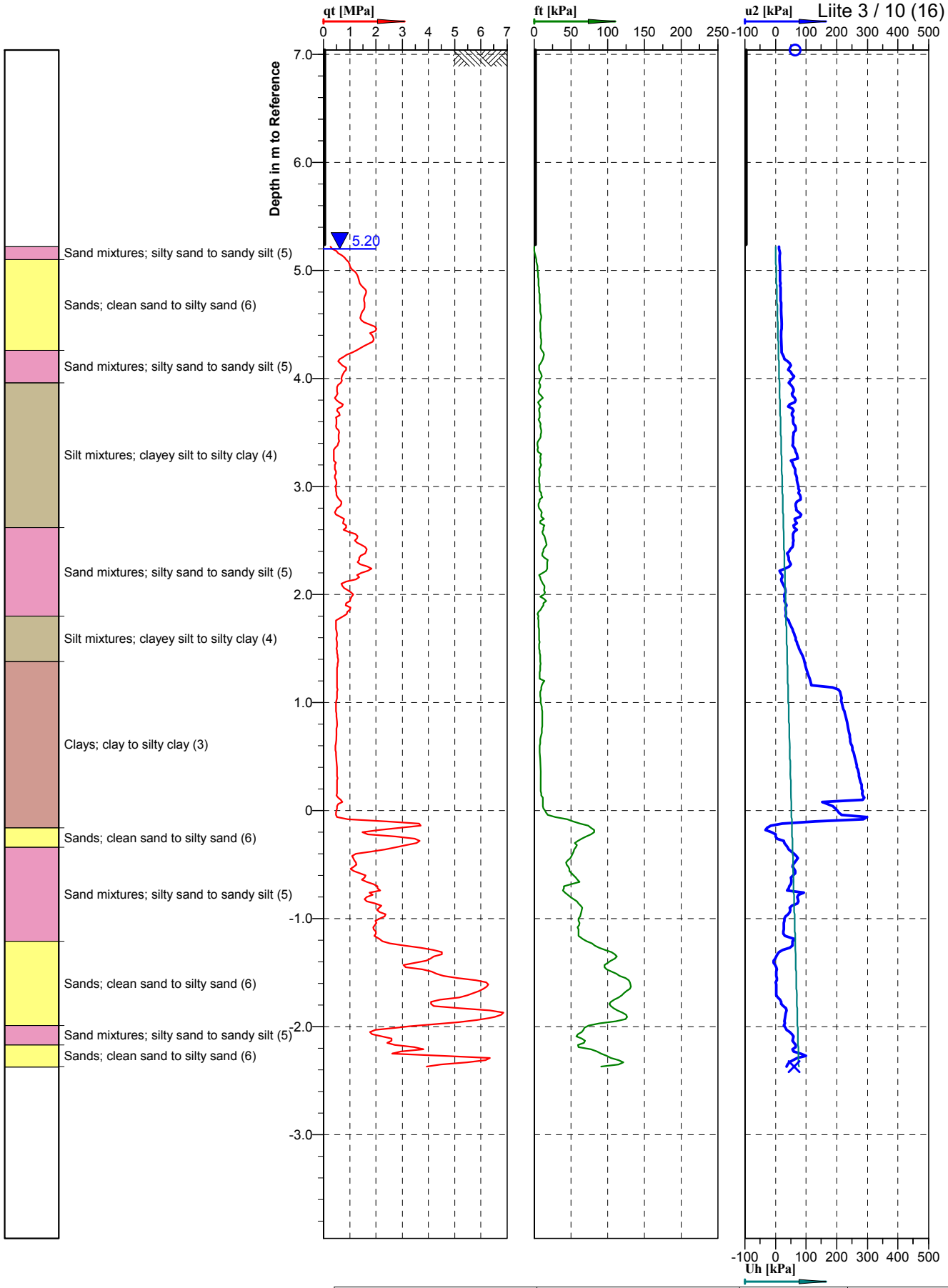
Cone No: 10 tn
Tip area [cm2]: 10
Sleeve area [cm2]: 150



U2

Cone No: 10 tn
Tip area [cm2]: 10
Sleeve area [cm2]: 150

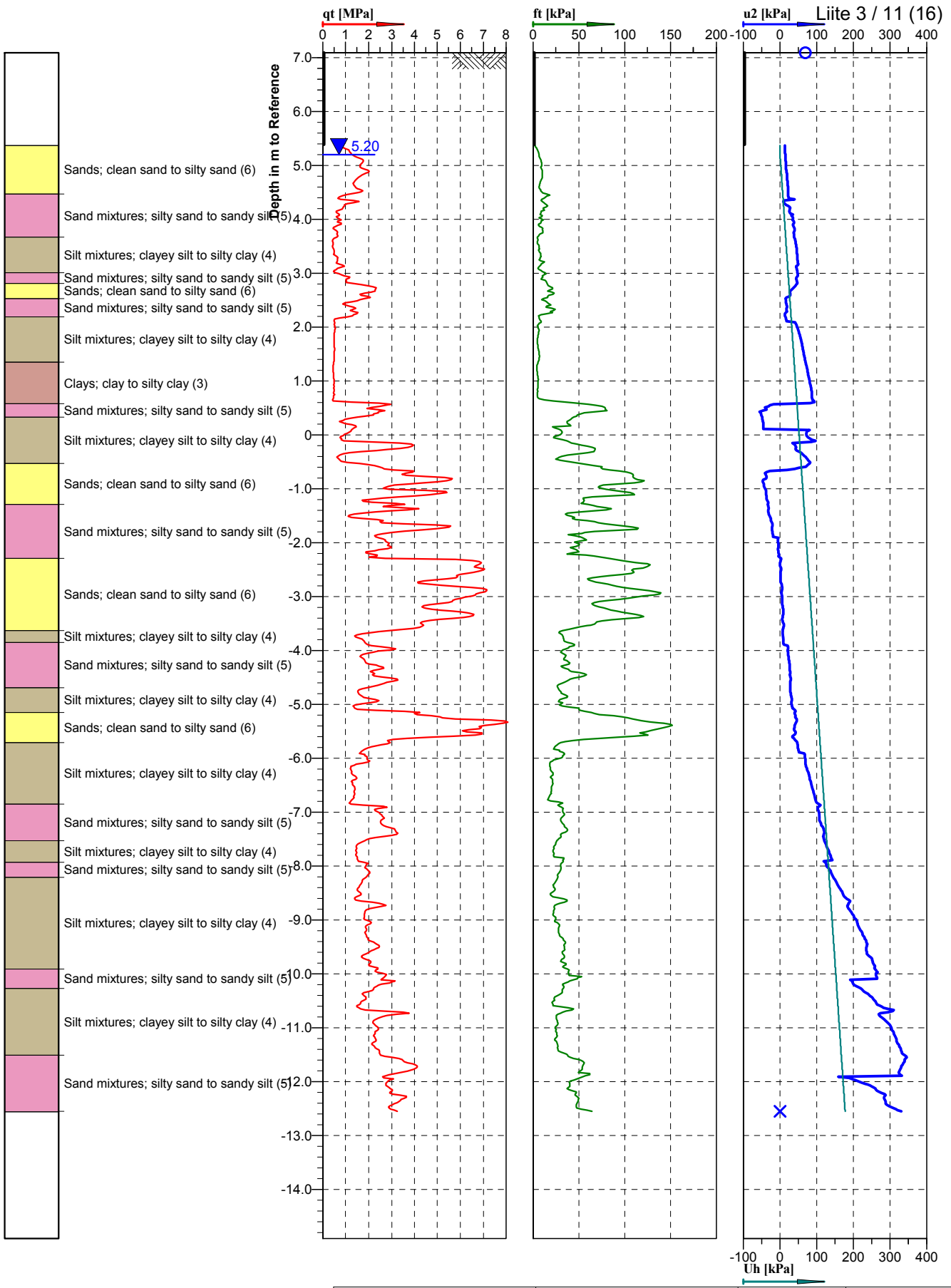
Location:	Position: X: 720 m, Y: 264 m	Ground level: 7.03	Test No.: 11
Project ID: 7399	Client:	Date: 20102014	Scale: 1 : 75
Project: ZATELLIITTI		Page: 1/1	Fig.:
		File: 11.cpd	



VR TRACK

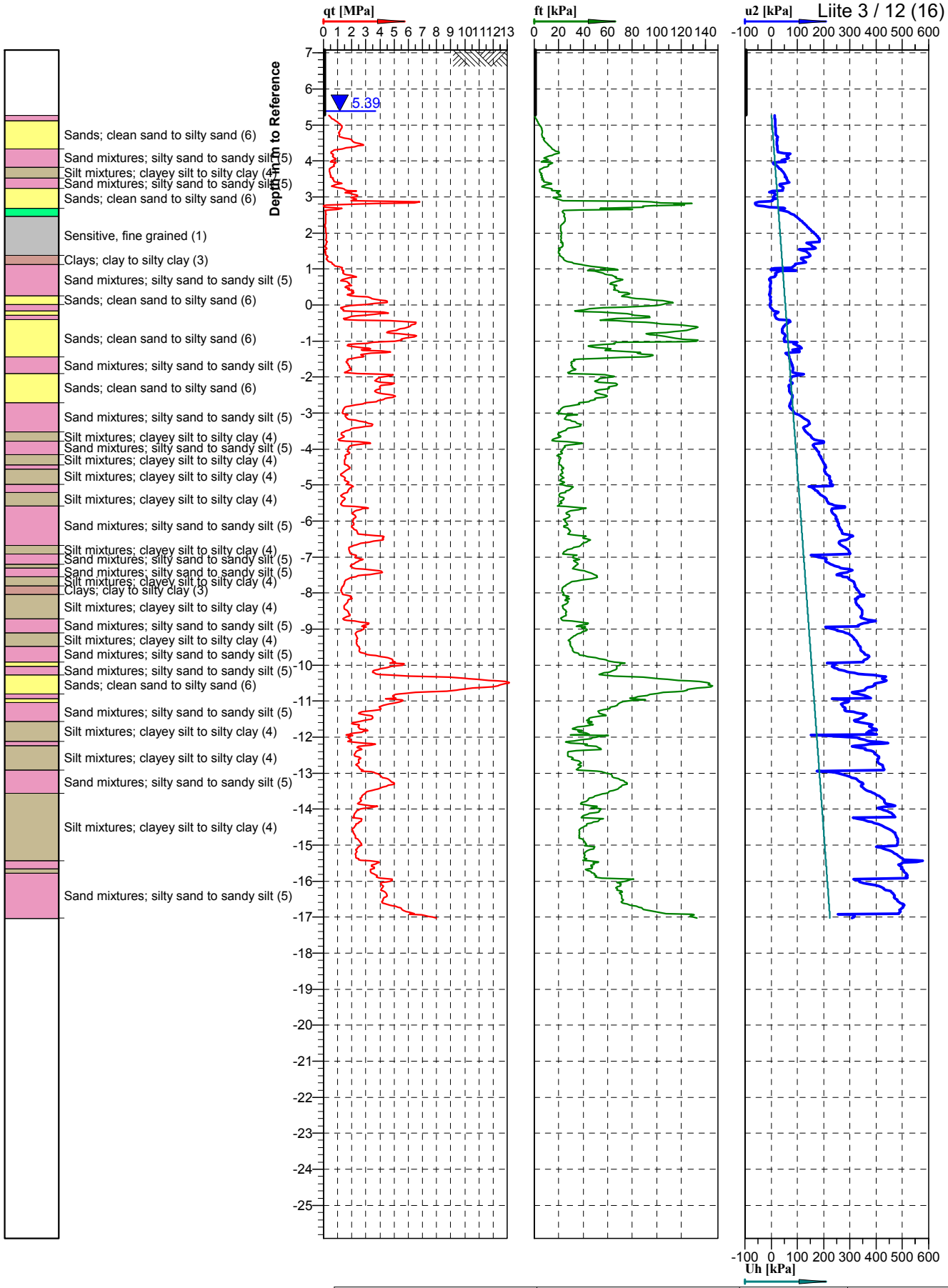
Cone No: 10 tn
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location:	Position: X: -999999 m, Y: -999999 m	Ground level: 7.04	Test No.: 10
Project ID: 7399	Client:	Date: 21102014	Scale: 1 : 50
Project: ZATELLIITTI		Page: 1/1	Fig.:
		File: 10.cpd	



Cone No: 10 tn
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location:	Position: X: -999999 m, Y: -999999 m	Ground level: 7.086	Test No.: 9
Project ID: 7399	Client:	Date: 16102014	Scale: 1 : 100
Project: ZATELLIITTI		Page: 1/1	Fig.:
		File: 9.cpd	

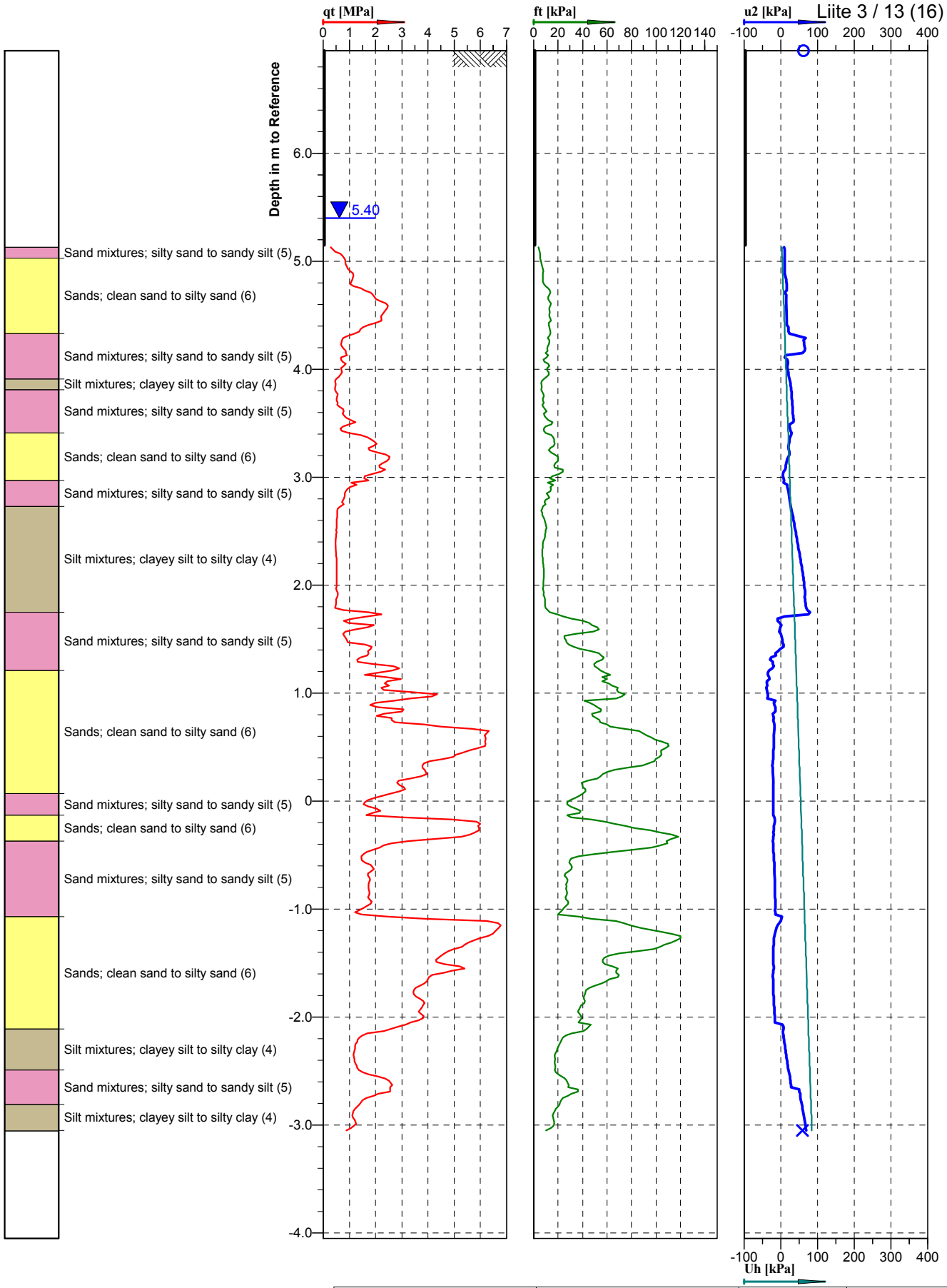


Location:	Position: X: 7202490.922 m, Y: 26477123.551 m	Ground level: 7.08	Test No.: 8
Project ID: Zatelliitti	Client:	Date: 28102014	Scale: 1 : 150
Project:		Page: 1/1	Fig.:
		File: 8.txt	

VR TRACK

U2

Cone No: 10 tn
Tip area [cm2]: 10
Sleeve area [cm2]: 150

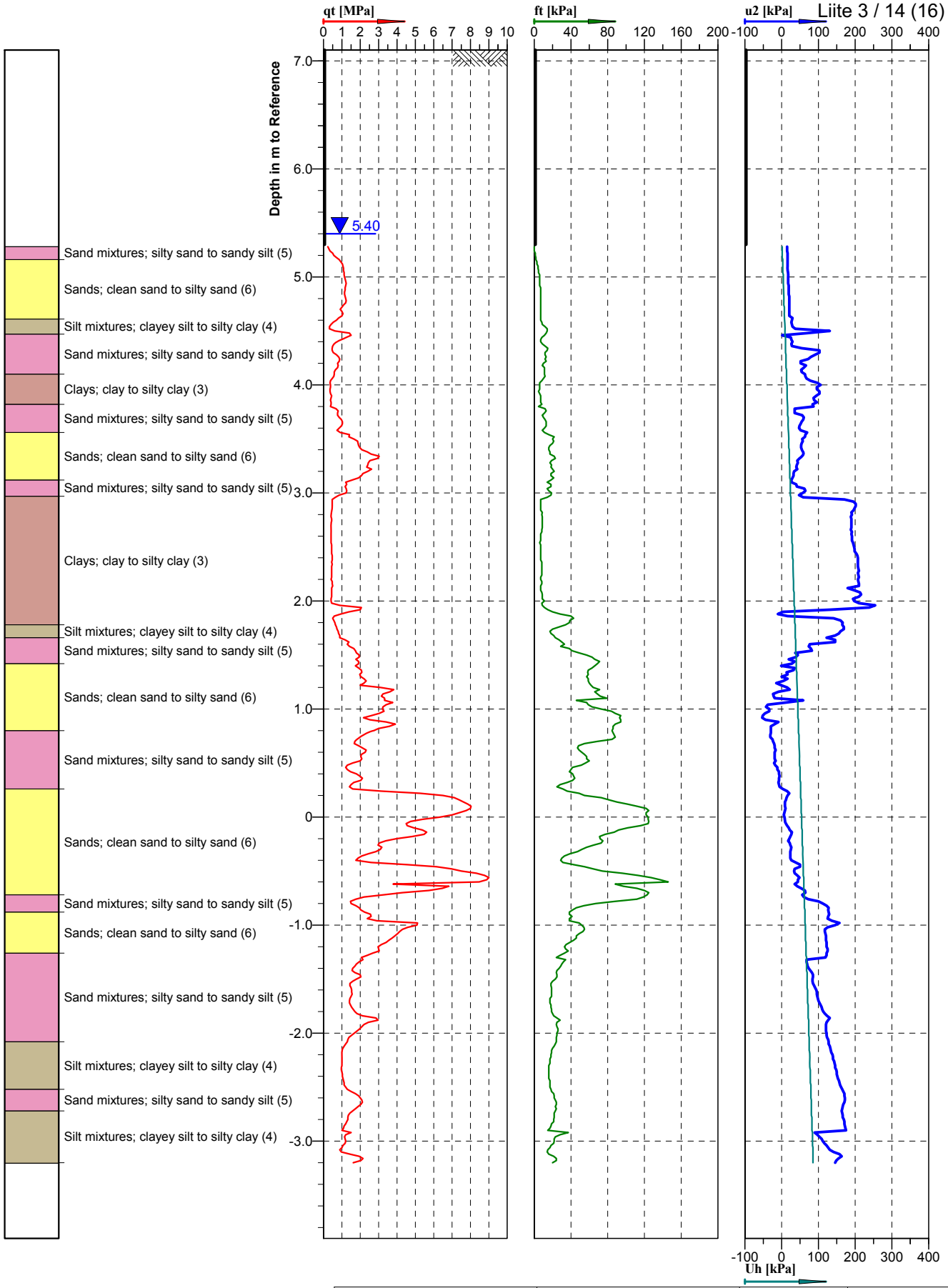


VR TRACK

U2

Cone No: 10 tn
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location:	Position: X: 7202491.900 m, Y: 26477113.529 m	Ground level: 6.95	Test No.: 7
Project ID: Zatelliitti	Client:	Date: 22102014	Scale: 1 : 50
Project:		Page: 1/1	Fig.:
		File: 7.cpd	

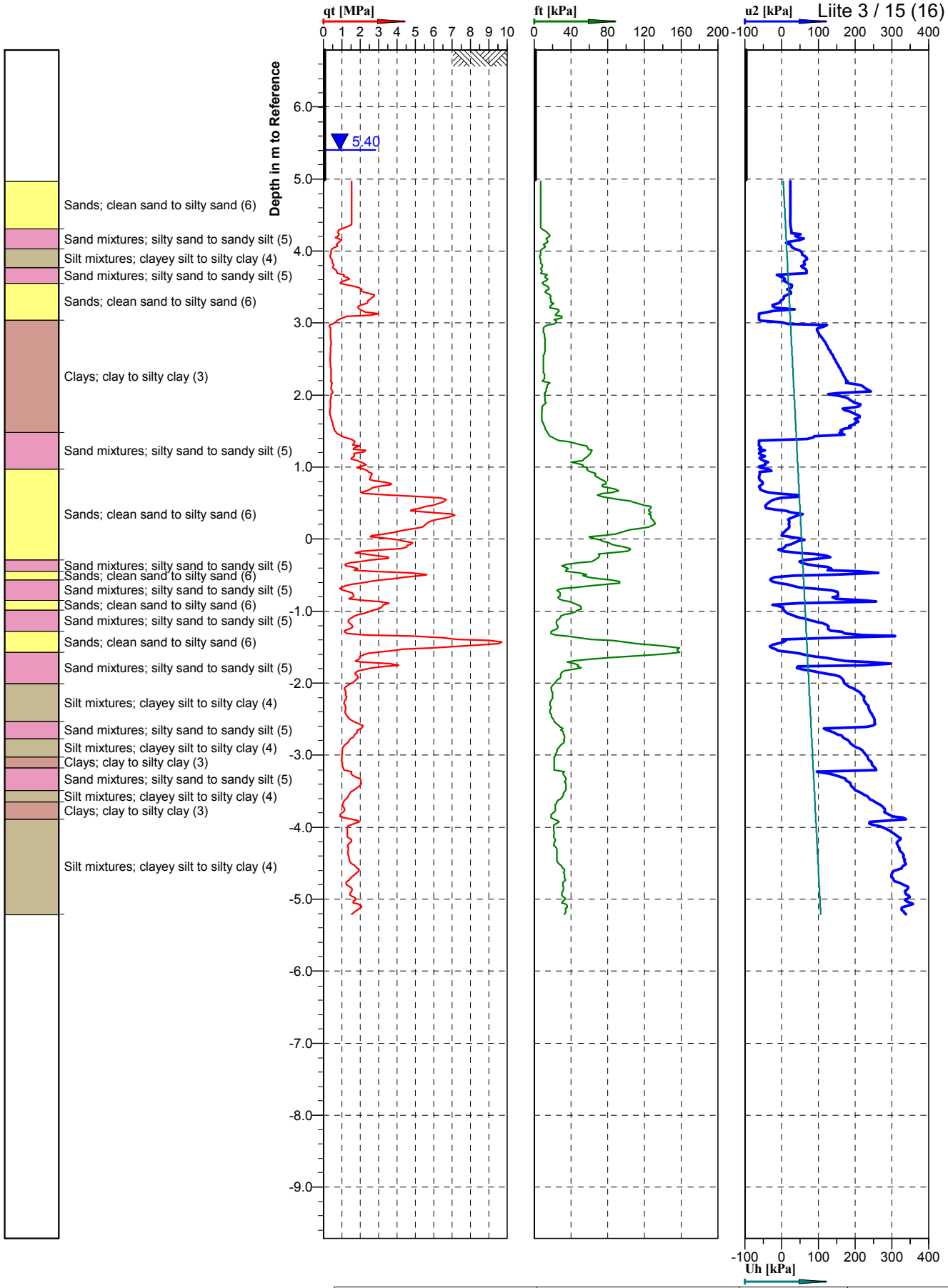


Location:	Position: X: 7202493.196 m, Y: 26477104.118 m	Ground level: 7.10	Test No.: 6
Project ID: Zatelliitti	Client:	Date: 27102014	Scale: 1 : 50
Project:		Page: 1/1	Fig.:
		File: 6.cpd	

VR TRACK

U2

Cone No: 10 tn
Tip area [cm2]: 10
Sleeve area [cm2]: 150

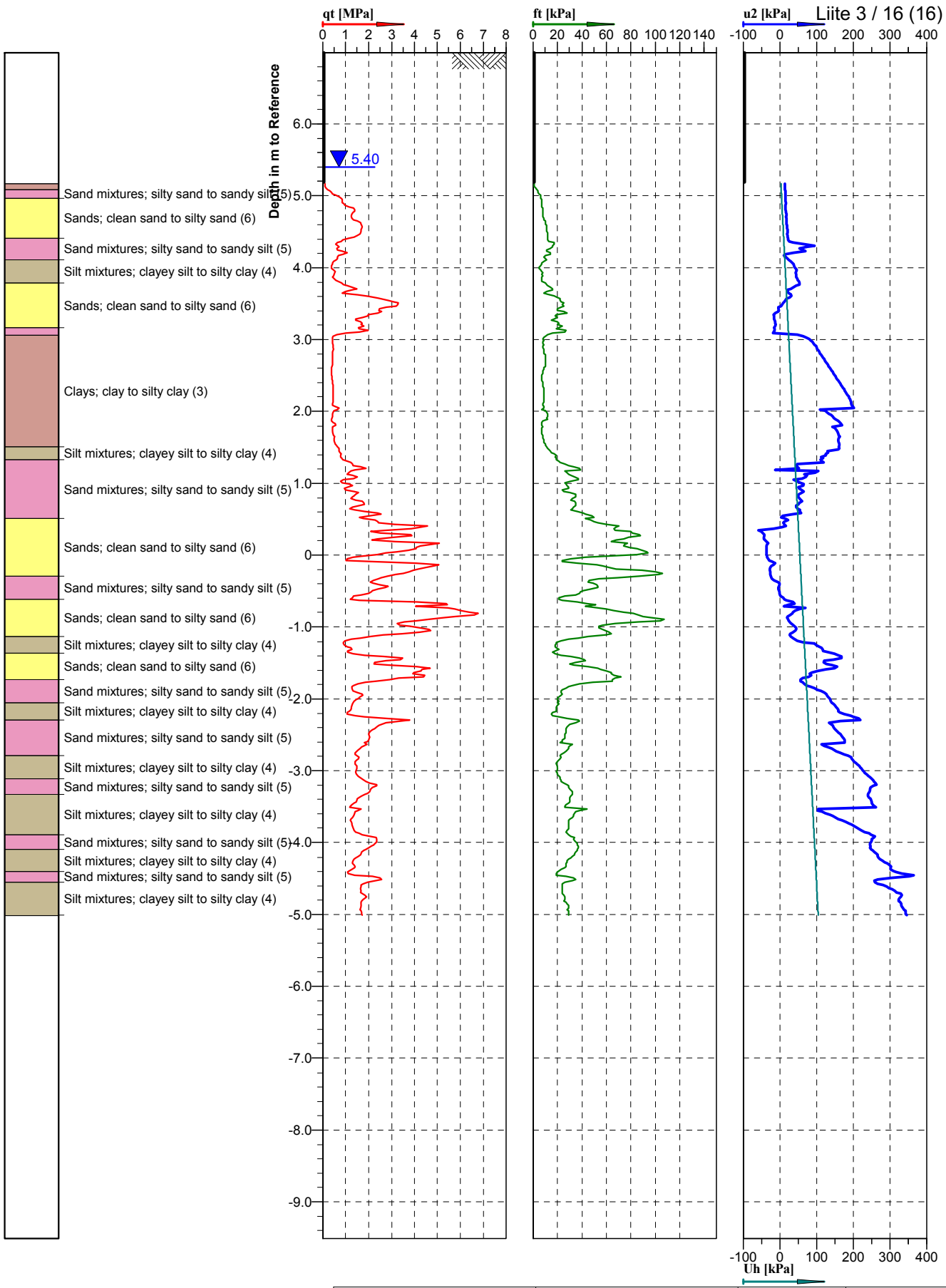


VR TRACK

U2

Cone No: 10 tn
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location:	Position: X: 7202493.661 m, Y: 26477094.334 m 6.790	Ground level:	Test No.: 5
Project ID: Zatelliitti	Client:	Date: 27102014	Scale: 1 : 75
Project:		Page: 1/1	Fig.:
		File: 5.cpd	

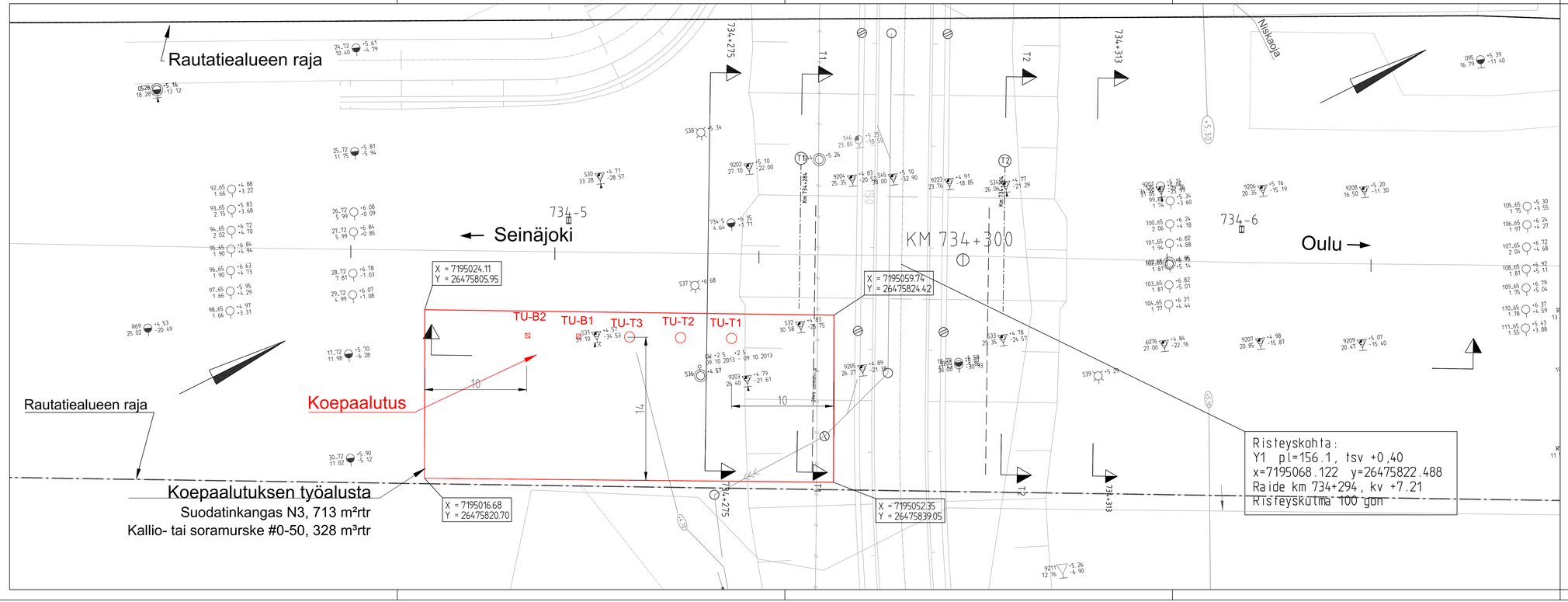


VR TRACK

U2

Cone No: 10 tn
Tip area [cm2]: 10
Sleeve area [cm2]: 150

Location:	Position: X: 7202495.326 m, Y: 26477084.348 m	Ground level: 6.987	Test No.: 4
Project ID: Zatelliitti	Client:	Date: 27102014	Scale: 1 : 75
Project:		Page: 1/1	Fig.:
		File: 4.cpd	



Vain koepaalutusta varten

MUUT.	SELITYS	PVM	TEHNYT	PVM	HYV.

TILAAJA: Liikennevirasto

HANKE: LIMINKA - OULU RAKENTAMISSUUNNITTELU

SUUNNITTELUVAIHE: RAKENTAMISSUUNNITTELU

TOIMITTAJA: VR TRACK

KOHDE JA KUNTA: TUULIHARJU ALIKULKUSILTA KM 734+294

PIIRT.	7.11.2014	Satu Joronen
SUUNN.	7.11.2014	Heikki Komulainen
TARK.	7.11.2014	Seppo Hakala
HYV.	7.11.2014	Hannu Siira

TARKASTAJA:

PIIRUSTUS: Pohjatutkimuskartta Koepaalutus KM 734+270 - 734+290

KUORMITUS:

KOORDINAATTI- JA KORKEUSJÄRJ.: GK 26 / N2000

RATAOSA: 008 / Sk -OI

KM - M: 734+294

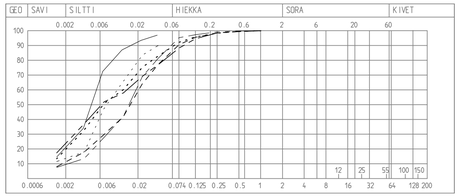
TARK.

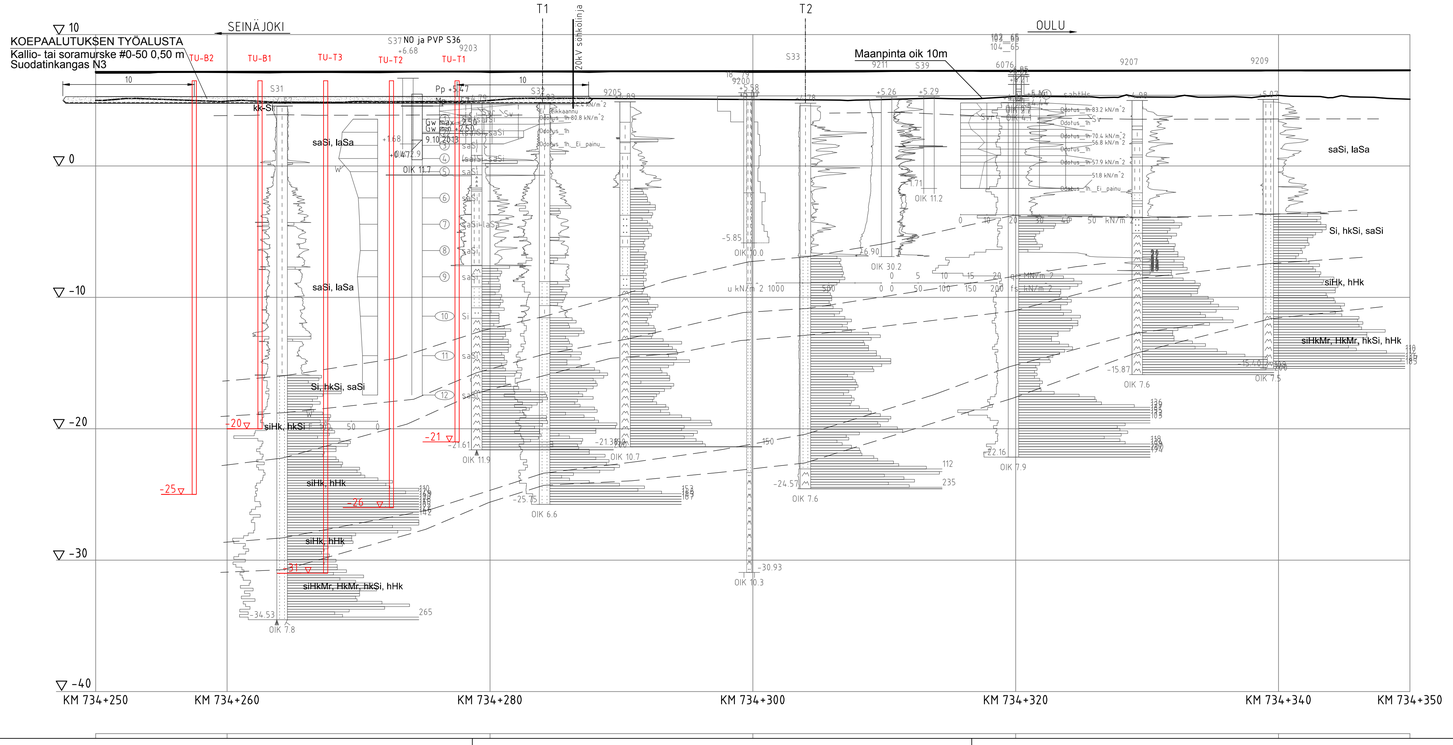
HYV.

TIL. HYV.

PAIKKA	LAJI	PIIR.NRO	MUUT.	LEHTI	LEHTIÄ
4034	GEO		-	1	

Näytepiste S36





Vain koepaalutusta varten

MUUT.	SELITYS	PVM	TEHNYT	PVM	HYV.

TILAAJA: Liikennevirasto

TOIMITTAJA: VR TRACK

PIIRT.	7.11.2014	Satu Joronen
SUUNN.	7.11.2014	Heikki Komulainen
TARK.	7.11.2014	Seppo Hakala
HYV.	7.11.2014	Hannu Siira

TARKASTAJA

TARK. HYV. TIL. HYV.

HANKE: LIMINKA - OULU RAKENTAMISSUUNNITTELU

SUUNNITTELUVAIHE: RAKENTAMISSUUNNITTELU

KOHDE JA KUNTA: TUULIHARJU ALIKULKUSILTA KM 734+294

PIIRUSTUS: Geotekninen pituusleikkaus oik Koepaalutus km 734+270 - 734+290

KUORMITUS

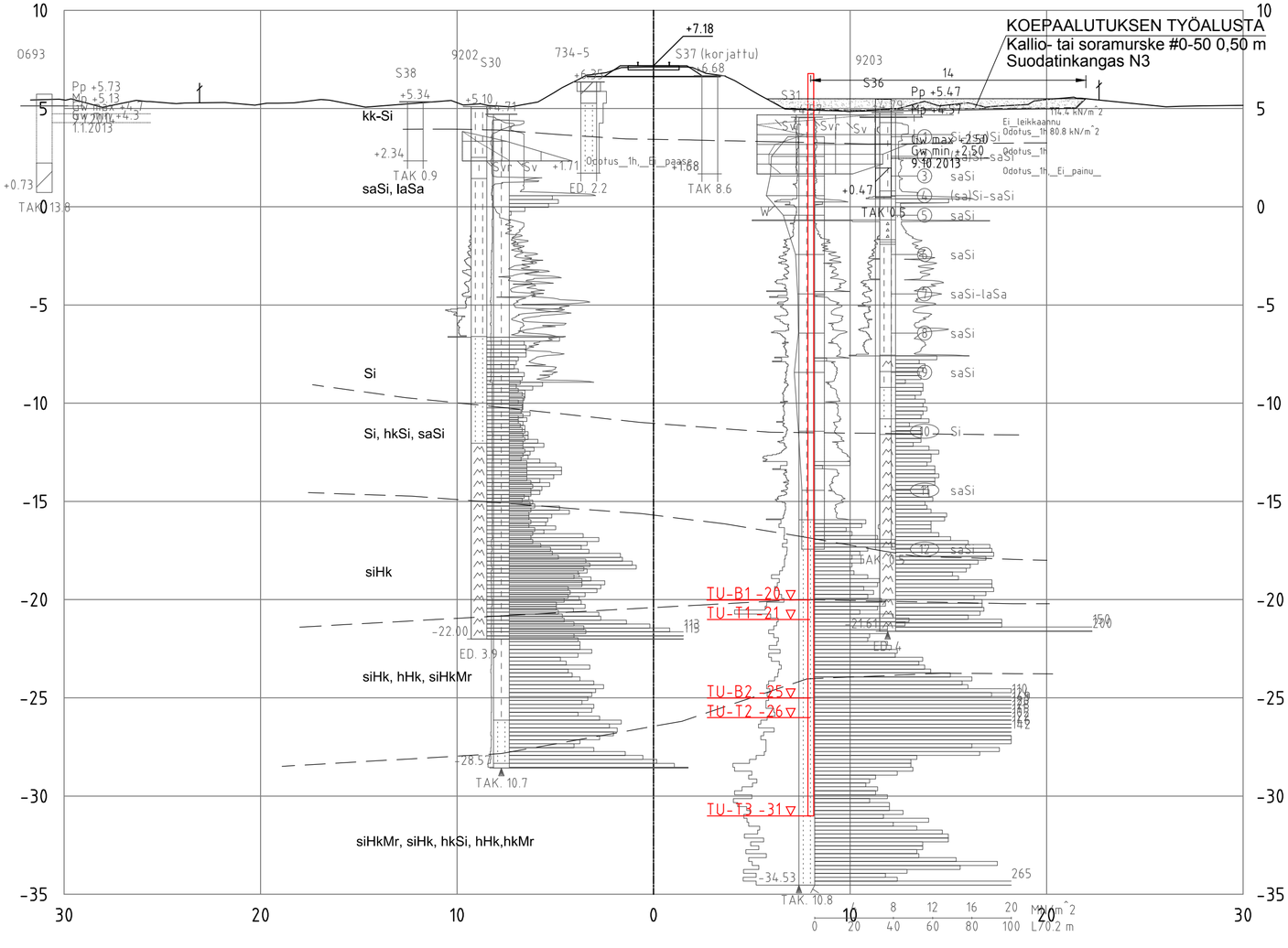
KOORDINAATTI- JA KORKEUSJÄRJ.: GK 26 / N2000

RATAOSA: 008 / Sk -OI

KM + M: 734+294

PAIKKA	LAJI	PIIR.NRO	MUUT.	LEHTI	LEHTIÄ
4034	GEO		-	2	

KM 734+275



Vain koepaalutusta varten

MUUT.	SELITYS	PVM	TEHNYT	PVM	HYV.

TILAAJA: Liikennevirasto

HANKE: LIMINKA - OULU RAKENTAMISSUUNNITTELU

SUUNNITTELUVAIHE: RAKENTAMISSUUNNITTELU

TOIMITTAJA: VR TRACK

KOHDE JA KUNTA: TUULIHARJUN ALIKULKUSILTA KM 734+294

PIIRT.	7.11.2014	Satu Joronen
SUUNN.	7.11.2014	Heikki Komulainen
TARK.	7.11.2014	Seppo Hakala
HYV.	7.11.2014	Hannu Siira

PIIRUSTUS: Poikkileikkaukset km 734+275 ja 734+284 Koepaalutus

TARKASTAJA

KUORMITUS

KOORDINAATTI- JA KORKEUSJÄRJ.: GK 26 / N2000

RATAOSA: 008 / Sk -Ol

KM + M: 734+294

TARK.		
HYV.		
TIL. HYV.		

PAIKKA	LAJI	PIIR.NRO	MUUT.	LEHTI	LEHTIÄ
4034	GEO		-	3	

Maasto-Seppo Oy

Koepaalutuspöytäkirja

Zateliitti	PM 20	5 t

Paalu	ZEB1	15+3+14

Lyöntitaso	noin +7,00

Tavoitetaso -23,00

Pudotus-korkeus m	Iskuja kpl	Painuma mm	Painuma mm/isku	Painuma mm/10 iskua	Jousto mm	kärjen syvyys mittaustasosta m	pvm	Huomautuksia, paalun jatkaminen, keskeytykset, ym
0,1	30	1000	33			1	24.2.15	
0,1	12	1000	83			2		
0,1	8	1000	125			3		
0,1	1	1000	1000			4		
0,1	1	1000	1000			5		
0,1	1	1000	1000			6		
0,1	1	1000	1000			7		
0,1	16	1000	63			8		
0,1	13	1000	77			9		
0,1	30	1000	33			10		
0,2	58	1000	17			11		
0,2	25	1000	40			12		
0,2	30	1000	33			13		
0,2	8	1000	125			14	3.3.15	jatkaminen
0,2	55	1000	18	182		15		
0,2	51	1000	20	196		16		
0,2	42	1000	24	238		17	3.3.15	jatkaminen
0,2	64	1000	16	156		18		
0,2	67	1000	15	149		19		
0,2	56	1000	18	179		20		
0,2	48	1000	21	208		21		
0,2	72	1000	14	139		22		
0,2	68	1000	15	147		23		
0,2	57	1000	18	175		24		
0,2	50	1000	20	200		25		
0,2	50	1000	20	200		26		
0,2	46	1000	22	217		27		
0,2	56	1000	18	179		28		
0,2	49	1000	20	204		29		
0,2	46	1000	22	217		30		

Maasto-Seppo Oy

Koepaalutuspöytäkirja

Zateliitti	PM 20	5 t

Paalu	ZET2	16+4+16

Lyöntitaso	noin +7,00	Tavoitetaso -28,00

Pudotus-korkeus m	Iskuja kpl	Painuma mm	Painuma mm/isku	Painuma mm/10 iskua	Jousto mm	kärjen syvyys mittaustasosta m	pvm	Huomautuksia, paalun jatkaminen, keskeytykset, ym
0,1	15	1000	67			1	24.2.15	
0,1	16	1000	63			2		
0,1	5	1000	200			3		
0,1	10	1000	100			4		
0,1	4	1000	250			5		
0,1	1	1000	1000			6		
0,1	1	1000	1000			7		
0,1	6	1000	167			8		
0,1	10	1000	100			9		
0,1	10	1000	100			10		
0,1	9	1000	111			11		
0,1	11	1000	91			12		
0,1	10	1000	100			13		
0,1	13	1000	77			14		vesitäyttö
0,1	12	1000	83			15	2.3.15	jatkaminen
0,1	75	1000	13	133		16		
0,1	45	1000	22	222		17		
0,1	48	1000	21	208		18		
0,1	40	1000	25	250		19		jatkaminen
0,1	42	1000	24	238		20		
0,1	42	1000	24	238		21		
0,1	40	1000	25	250		22		
0,1	51	1000	20	196		23		
0,1	42	1000	24	238		24		
0,1	40	1000	25	250		25		
0,1	40	1000	25	250		26		
0,1	40	1000	25	250		27		
0,1	45	1000	22	222		28		
0,1	40	1000	25	250		29		
0,1	35	1000	29	286		30		
0,1	37	1000	27	270		31		
0,2	38	1000	26	263		32		
0,3	99	1000	10	101		33		
0,4	119	1000	8	84		34		
0,5	55	1000	18	182		35		

Maasto-Seppo Oy

Koepaalutuspöytäkirja

Zateliitti	PM 20	5 t

Paalu	ZET1	16+16

Lyöntitaso	noin +7,00	Tavoitetaso -23,00

Pudotus-korkeus m	Iskuja kpl	Painuma mm	Painuma mm/isku	Painuma mm/10 iskua	Jousto mm	kärjen syvyys mittaustasosta m	pvm	Huomautuksia, paalun jatkaminen, keskeytykset, ym
0,1	15	1000	67			1	24.2.15	
0,1	13	1000	77			2		
0,1	6	1000	167			3		
0,1	1	1000	1000			4		
0,1	5	1000	200			5		
0,1	1	1000	1000			6		
0,1	10	1000	100			7		
0,1	15	1000	67			8		
0,1	14	1000	71			9		
0,1	20	1000	50			10		
0,1	20	1000	50			11		
0,1	15	1000	67			12		
0,1	21	1000	48			13		
0,1	20	1000	50			14		vesitäyttö
0,1	22	1000	45	455		15	2.3.15	jatkaminen
0,2	50	1000	20	200		16		
0,2	50	1000	20	200		17		
0,2	49	1000	20	204		18		
0,2	46	1000	22	217		19		
0,2	47	1000	21	213		20		
0,2	45	1000	22	222		21		
0,2	89	1000	11	112		22		
0,2	59	1000	17	169		23		
0,2	50	1000	20	200		24		
0,2	46	1000	22	217		25		
0,2	45	1000	22	222		26		
0,2	47	1000	21	213		27		
0,2	52	1000	19	192		28		
0,2	54	1000	19	185		29		
0,2	84	1500	18	179		30,5		
						31		

Maasto-Seppo Oy

Koepaalutuspöytäkirja

Zateliitti	PM 20	5 t

Paalu	ZEB2	15+7+15

Lyöntitaso	noin +7,00	Tavoitetaso -29,00

Pudotus-korkeus m	Iskuja kpl	Painuma mm	Painuma mm/isku	Painuma mm/10 iskua	Jousto mm	kärjen syvyys mittaustasosta m	pvm	Huomautuksia, paalun jatkaminen, keskeytykset, ym
0,1	40	1000	25			1	24.2.15	
0,1	15	1000	67			2		
0,1	18	1000	56			3		
0,1	3	1000	333			4		
0,1	27	1000	37			5		
0,1	1	1000	1000			6		
0,1	5	1000	200			7		
0,1	16	1000	63			8		
0,1	50	1000	20			9		
0,1	45	1000	22			10		
0,3	44	1000	23			11		
0,3	33	1000	30			12		
0,3	46	1000	22			13		
0,3	42	1000	24			14	3.3.15	jatkaminen
0,3	58	1000	17	172		15		
0,3	49	1000	20	204		16		
0,3	40	1000	25	250		17		
0,3	44	1000	23	227		18		
0,3	40	1000	25	250		19		
0,3	40	1000	25	250		20		
0,3	39	1000	26	256		21		
0,2	102	1000	10	98		22	3.3.15	jatkaminen
0,2	100	1000	10	100		23		
0,2	68	1000	15	147		24		
0,2	56	1000	18	179		25		
0,2	58	1000	17	172		26		
0,2	48	1000	21	208		27		
0,2	50	1000	20	200		28		
0,2	53	1000	19	189		29		
0,2	70	1000	14	143		30		
0,2	56	1000	18	179		31		
0,2	55	1000	18	182		32		
0,2	55	1000	18	182		33		
0,2	50	1000	20	200		34		
0,2	51	1000	20	196		35		
0,2	37	1000	27	270		36		

Maasto-Seppo Oy

Koepaalutuspöytäkirja

Zateliitti	PM 20	5 t

Paalu	ZPT6	16+13

Lyöntitaso	noin +7,00

Tavoitetaso -20,00

Pudotus-korkeus m	Iskuja kpl	Painuma mm	Painuma mm/isku	Painuma mm/10 iskua	Jousto mm	kärjen syvyys mittaustasosta m	pvm	Huomautuksia, paalun jatkaminen, keskeytykset, ym
0,1	20	1000	50			1	24.2.15	
0,1	8	1000	125			2		
0,1	1	1000	1000			3		
0,1	1	1000	1000			4		
0,1	1	1000	1000			5		
0,1	1	1000	1000			6		
0,1	1	1000	1000			7		
0,1	1	1000	1000			8		
0,1	1	1000	1000			9		
0,1	20	1000	50			10		
0,1	25	1000	40			11		
0,1	20	1000	50			12		
0,1	20	1000	50			13		
0,1	20	1000	50			14		vesitäyttö
0,1	10	1000	100			15	2.3.15	jatkaminen
0,2	59	1000	17	169		16		
0,2	47	1000	21	213		17		
0,2	49	1000	20	204		18		
0,2	50	1000	20	200		19		
0,2	51	1000	20	196		20		
0,2	48	1000	21	208		21		
0,2	43	1000	23	233		22		
0,2	48	1000	21	208		23		
0,2	54	1000	19	185		24		
0,2	43	1000	23	233		25		
0,2	36	1000	28	278		26		
0,2	35	1000	29	286		27		

Maasto-Seppo Oy

Koepaalutuspöytäkirja

Zateliitti	PM 20	5 t

Paalu	ZPT5	16+3+16

Lyöntitaso	noin +7,00

Tavoitetaso -25,00

Pudotus-korkeus m	Iskuja kpl	Painuma mm	Painuma mm/isku	Painuma mm/10 iskua	Jousto mm	kärjen syvyys mittaustasosta m	pvm	Huomautuksia, paalun jatkaminen, keskeytykset, ym
0,1	20	1000	50			1	24.2.15	
0,1	5	1000	200			2		
0,1	1	1000	1000			3		
0,1	1	1000	1000			4		
0,1	1	1000	1000			5		
0,1	1	1000	1000			6		
0,1	1	1000	1000			7		
0,1	1	1000	1000			8		
0,1	10	1000	100			9		
0,1	10	1000	100			10		
0,1	15	1000	67			11		
0,1	22	1000	45			12		
0,1	22	1000	45			13		
0,1	15	1000	67			14		vesitäyttö
0,2	25	1000	40			15	2.3.15	jatkaminen
0,2	49	1000	20	204		16		
0,2	79	1000	13	127		17		
0,2	67	1000	15	149		18		jatkaminen
0,2	60	1000	17	167		19		
0,2	47	1000	21	213		20		
0,2	54	1000	19	185		21		
0,2	59	1000	17	169		22		
0,2	59	1000	17	169		23		
0,2	63	1000	16	159		24		
0,3	61	1000	16	164		25		
0,3	49	1000	20	204		26		
0,3	53	1000	19	189		27		
0,3	60	1000	17	167		28		
0,3	54	1000	19	185		29		
0,3	45	1000	22	222		30		
0,3	37	1000	27	270		31		
0,3	33	1000	30	303		32		
0,3	30	1000	33	333		33		

Maasto-Seppo Oy

Koepaalutuspöytäkirja

Zateliitti	PM 20	5 t

Paalu	ZPT4	16+7+16

Lyöntitaso	noin +7,00	Tavoitetaso -30,00

Pudotus-korkeus m	Iskuja kpl	Painuma mm	Painuma mm/isku	Painuma mm/10 iskua	Jousto mm	kärjen syvyys mittaustasosta m	pvm	Huomautuksia, paalun jatkaminen, keskeytykset, ym
0,1	14	1000	71			1	24.2.15	
0,1	14	1000	71			2		
0,1	1	1000	1000			3		
0,1	1	1000	1000			4		
0,1	1	1000	1000			5		
0,1	5	1000	200			6		
0,1	1	1000	1000			7		
0,1	1	1000	1000			8		
0,1	1	1000	1000			9		
0,1	1	1000	1000			10		
0,1	11	1000	91			11		
0,1	9	1000	111			12		
0,1	15	1000	67			13		
0,1	18	1000	56			14		vesitäyttö
0,2	20	1000	50			15	2.3.15	jatkaminen
0,2	63	1000	16	159		16		
0,2	72	1000	14	139		17		
0,2	70	1000	14	143		18		
0,2	75	1000	13	133		19		
0,2	72	1000	14	139		20		
0,2	75	1000	13	133		21		
0,2	70	1000	14	143		22		jatkaminen
0,2	69	1000	14	145		23		
0,3	57	1000	18	175		24		
0,3	68	1000	15	147		25		
0,3	65	1000	15	154		26		
0,3	57	1000	18	175		27		
0,3	62	1000	16	161		28		
0,3	50	1000	20	200		29		
0,3	50	1000	20	200		30		
0,3	52	1000	19	192		31		
0,3	54	1000	19	185		32		
0,3	54	1000	19	185		33		
0,3	40	1000	25	250		34		
0,3	44	1000	23	227		35		
0,3	50	1000	20	200		36		
0,3	53	1000	19	189		37		

Maasto-Seppo Oy

Koepaalutuspöytäkirja

Zateliitti	PM 20	5 t

Paalu	ZPB4	15+4+15

Lyöntitaso	noin +7,00	Tavoitetaso -25,00

Pudotus-korkeus m	Iskuja kpl	Painuma mm	Painuma mm/isku	Painuma mm/10 iskua	Jousto mm	kärjen syvyys mittaustasosta m	pvm	Huomautuksia, paalun jatkaminen, keskeytykset, ym
0,1	20	1000	50			1	24.2.15	
0,1	8	1000	125			2		
0,1	4	1000	250			3		
0,1	3	1000	333			4		
0,1	8	1000	125			5		
0,1	1	1000	1000			6		
0,1	1	1000	1000			7		
0,1	1	1000	1000			8		
0,1	15	1000	67			9		
0,1	20	1000	50			10		
0,1	20	1000	50			11		
0,1	25	1000	40			12		
0,1	30	1000	33			13		
0,1	25	1000	40			14	3.3.15	jatkaminen
0,1	70	1000	14	143		15		
0,1	100	1000	10	100		16		
0,1	110	1000	9	91		17		
0,1	65	1000	15	154		18		jatkaminen
0,1	75	1000	13	133		19		
0,2	88	1000	11	114		20		
0,2	90	1000	11	111		21		
0,2	100	1000	10	100		22		
0,2	65	1000	15	154		23		
0,2	62	1000	16	161		24		
0,2	64	1000	16	156		25		
0,1	75	1000	13	133		26		
0,1	100	1000	10	100		27		
0,1	67	1000	15	149		28		
0,1	82	1000	12	122		29		
0,1	78	1000	13	128		30		
0,1	77	1000	13	130		31		
0,1	50	1000	20	200		32		

Maasto-Seppo Oy

Koepaalutuspöytäkirja

Zateliitti	PM 20	5 t

Paalu	ZPB3	15+14

Lyöntitaso	noin +7,00	Tavoitetaso -20,00

Pudotus-korkeus m	Iskuja kpl	Painuma mm	Painuma mm/isku	Painuma mm/10 iskua	Jousto mm	kärjen syvyys mittaustasosta m	pvm	Huomautuksia, paalun jatkaminen, keskeytykset, ym
0,1	20	1000	50			1	24.2.15	
0,1	12	1000	83			2		
0,1	1	1000	1000			3		
0,1	1	1000	1000			4		
0,1	13	1000	77			5		
0,1	1	1000	1000			6		
0,1	1	1000	1000			7		
0,1	1	1000	1000			8		
0,1	20	1000	50			9		
0,1	45	1000	22			10		
0,1	50	1000	20			11		
0,2	30	1000	33			12		
0,2	20	1000	50			13		
0,2	23	1000	43			14	3.3.15	jatkaminen
0,2	43	1000	23	233		15		
0,2	58	1000	17	172		16		
0,2	48	1000	21	208		17		
0,2	48	1000	21	208		18		
0,2	43	1000	23	233		19		
0,2	42	1000	24	238		20		
0,2	43	1000	23	233		21		
0,2	46	1000	22	217		22		
0,2	62	1000	16	161		23		
0,2	46	1000	22	217		24		
0,2	46	1000	22	217		25		
0,2	48	1000	21	208		26		
0,2	31	1000	32	323		27		

Maasto-Seppo Oy

Koepaalutuspöytäkirja

Zateliitti	PM 20	5 t

Paalu	ZET3	16+8+16

Lyöntitaso	noin +7,00	Tavoitetaso -32,00

Pudotus-korkeus m	Iskuja kpl	Painuma mm	Painuma mm/isku	Painuma mm/10 iskua	Jousto mm	kärjen syvyys mittaustasosta m	pvm	Huomautuksia, paalun jatkaminen, keskeytykset, ym
0,1	16	1000	63			1	24.2.15	
0,1	28	1000	36			2		
0,1	4	1000	250			3		
0,1	2	1000	500			4		
0,1	1	1000	1000			5		
0,1	1	1000	1000			6		
0,1	10	1000	100			7		
0,1	15	1000	67			8		
0,1	10	1000	100			9		
0,1	28	1000	36			10		
0,1	23	1000	43			11		
0,1	20	1000	50			12		
0,1	12	1000	83			13		
0,1	20	1000	50			14		vesitäyttö
0,1	20	1000	50			15	2.3.15	jatkaminen
0,1	50	1000	20	200		16		
0,1	62	1000	16	161		17		
0,1	49	1000	20	204		18		
0,1	43	1000	23	233		19		
0,1	42	1000	24	238		20		
0,1	39	1000	26	256		21		
0,1	51	1000	20	196		22		
0,1	50	1000	20	200		23		jatkaminen
0,1	30	1000	33	333		24		
0,1	47	1000	21	213		25		
0,1	54	1000	19	185		26		
0,1	56	1000	18	179		27		
0,1	58	1000	17	172		28		
0,1	47	1000	21	213		29		
0,1	48	1000	21	208		30		
0,1	51	1000	20	196		31		
0,1	50	1000	20	200		32		
0,2	63	1000	16	159		33		
0,3	121	1000	8	83		34		
0,5	320	1000	3	31		35		
0,5	255	1000	4	39		36		
0,5	341	1000	3	29		37		
0,5	426	1000	2	23		38		

Maasto-Seppo Oy

Koepaalutuspöytäkirja

Tuuliharju	PM 25	5 t

Paalu	TU-B1	15+12

Lyöntitaso	noin +5,50	Tavoitetaso -20,00

Pudotus-korkeus m	Iskuja kpl	Painuma mm	Painuma mm/isku	Painuma mm/10 iskua	Jousto mm	kärjen syvyys mittaustasosta m	pvm	Huomautuksia, paalun jatkaminen, keskeytykset, ym
0,25	5	1000	200			1	20.2.15	
0,25	1	1000	1000			2		murskekerroksen jälkeen
0,25	1	1000	1000			3		vasaran painolla 7 m
0,25	1	1000	1000			4		
0,25	1	1000	1000			5		
0,25	1	1000	1000			6		
0,25	1	1000	1000			7		
0,25	10	1000	100			8		
0,25	11	1000	91			9		
0,25	12	1000	83			10		
0,25	10	1000	100			11		
0,25	10	1000	100			12		
0,25	12	1000	83			13		
0,25	12	1000	83			14	4.3.15	jatkaminen
0,25	54	1000	19			15		
0,25	29	1000	34			16		
0,25	25	1000	40			17		
0,25	21	1000	48			18		
0,25	25	1000	40			19		
0,25	22	1000	45			20		
0,25	24	1000	42			21		
0,25	37	1000	27			22		
0,25	72	1000	14	139		23		
0,3	151	1000	7	66		24		
0,3	231	1000	4	43		25		
						26		

Maasto-Seppo Oy

Koepaalutuspöytäkirja

Tuuliharju	PM 25	5 t

Paalu	TU-T1	16+16

Lyöntitaso	noin +5,50	Tavoitetaso -21,00

Pudotus-korkeus m	Iskuja kpl	Painuma mm	Painuma mm/isku	Painuma mm/10 iskua	Jousto mm	kärjen syvyys mittaustasosta m	pvm	Huomautuksia, paalun jatkaminen, keskeytykset, ym
0,2	17	1000	59			1	24.2.15	
0,2	3	1000	333			2		
0,2	1	1000	1000			3		
0,2	1	1000	1000			4		
0,2	1	1000	1000			5		
0,2	1	1000	1000			6		
0,2	23	1000	43			7		
0,2	7	1000	143			8		
0,2	11	1000	91			9		
0,2	12	1000	83			10		
0,2	12	1000	83			11		
0,2	11	1000	91			12		
0,2	12	1000	83			13		
0,2	17	1000	59			14		vesitäyttö
0,2	12	1000	83	833		15	4.3.15	jatkaminen
0,2	20	1000	50	500		16		
0,2	23	1000	43	435		17		
0,2	19	1000	53	526		18		
0,2	21	1000	48	476		19		
0,2	16	1000	63	625		20		
0,2	20	1000	50	500		21		
0,2	45	1000	22	222		22		
0,2	82	1000	12	122		23		
0,4	118	1000	8	85		24		
0,4	125	1000	8	80		25		
0,4	270	1000	4	37		26		
0,4	220	1000	5	45		27		vesitäyttö

Maasto-Seppo Oy

Koepaalutuspöytäkirja

Tuuliharju	PM 25	Paalu	TU-B2	15+10+7

Lyöntitaso	noin +5,50	Tavoitetaso -25,00

Pudotus-korkeus m	Iskuja kpl	Painuma mm	Painuma mm/isku	Painuma mm/10 iskua	Jousto mm	kärjen syvyys mittaustasosta m	pvm	Huomautuksia, paalun jatkaminen, keskeytykset, ym
0,25	5	1000	200			1	20.2.15	
0,25	1	1000	1000			2		murskekerroksen jälkeen
0,25	1	1000	1000			3		vasaran painolla 7 m
0,25	1	1000	1000			4		
0,25	1	1000	1000			5		
0,25	1	1000	1000			6		
0,25	1	1000	1000			7		
0,25	10	1000	100			8		
0,25	12	1000	83			9		
0,25	10	1000	100			10		
0,25	10	1000	100			11		
0,25	10	1000	100			12		
0,25	12	1000	83			13		
0,25	53	1000	19			14	4.3.15	jatkaminen
0,25	32	1000	31			15		
0,25	26	1000	38			16		
0,25	21	1000	48			17		
0,25	26	1000	38			18		
0,25	28	1000	36			19		
0,25	27	1000	37			20		
0,25	30	1000	33			21		
0,25	31	1000	32			22		
0,25	44	1000	23	227		23		
0,25	231	1000	4			24		
						25		
						26		
						27		
						28		
						29		
						30		
						31		
						32		

Maasto-Seppo Oy

Koepaalutuspöytäkirja

Tuuliharju	PM 25	5 t

Paalu	TU-T3	16+6+12

Lyöntitaso	noin +5,50	Tavoitetaso -31,00

Pudotus-korkeus m	Iskuja kpl	Painuma mm	Painuma mm/isku	Painuma mm/10 iskua	Jousto mm	kärjen syvyys mittaustasosta m	pvm	Huomautuksia, paalun jatkaminen, keskeytykset, ym
0,2	12	1000	83			1	24.2.15	
0,2	2	1000	500			2		
0,2	1	1000	1000			3		
0,2	1	1000	1000			4		
0,2	1	1000	1000			5		
0,2	4	1000	250			6		
0,2	1	1000	1000			7		
0,2	8	1000	125			8		
0,2	6	1000	167			9		
0,2	7	1000	143			10		
0,2	6	1000	167			11		
0,2	8	1000	125			12		
0,2	13	1000	77			13		
0,2	17	1000	59			14		vesitäyttö
0,2	16	1000	63			15	4.3.15	jatkaminen
0,2	33	1000	30			16		
0,2	11	1000	91			17		
0,2	19	1000	53			18		
0,2	19	1000	53			19		
0,2	21	1000	48			20		
0,2	22	1000	45			21	4.3.15	jatkaminen
0,2	56	1000	18	179		22		
0,2	208	1000	5	48		23		
0,4	243	1000	4	41		24		
0,4	317	1000	3	32		25		vesitäyttö
						26		
						27		
						28		
						29		
						30		
						31		
						32		
						33		
						34		

Maasto-Seppo Oy

Koepaalutuspöytäkirja

Tuuliharju	PM 25	5 t

Paalu	TU-T2	16+3+14

Lyöntitaso	noin +5,50	Tavoitetaso -26,00

Pudotus-korkeus m	Iskuja kpl	Painuma mm	Painuma mm/isku	Painuma mm/10 iskua	Jousto mm	kärjen syvyys mittaustasosta m	pvm	Huomautuksia, paalun jatkaminen, keskeytykset, ym
0,2	15	1000	67			1	24.2.15	
0,2	2	1000	500			2		
0,2	1	1000	1000			3		
0,2	1	1000	1000			4		
0,2	1	1000	1000			5		
0,2	8	1000	125			6		
0,2	1	1000	1000			7		
0,2	11	1000	91			8		
0,2	12	1000	83			9		
0,2	12	1000	83			10		
0,2	12	1000	83			11		
0,2	11	1000	91			12		
0,2	13	1000	77			13		
0,2	18	1000	56			14		vesitäyttö
0,2	17	1000	59			15	4.3.15	jatkaminen
0,2	33	1000	30			16		
0,2	27	1000	37			17		
0,2	30	1000	33			18	4.3.15	jatkaminen
0,2	29	1000	34			19		
0,2	26	1000	38	385		20		
0,2	28	1000	36	357		21		
0,2	59	1000	17	169		22		
0,4	199	1000	5	50		23		
0,5	280	1000	4	36		24		
0,6	230	1000	4	43		25		
0,6	223	1000	4	45		26		vesitäyttö
						27		

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PDA OP: TRe

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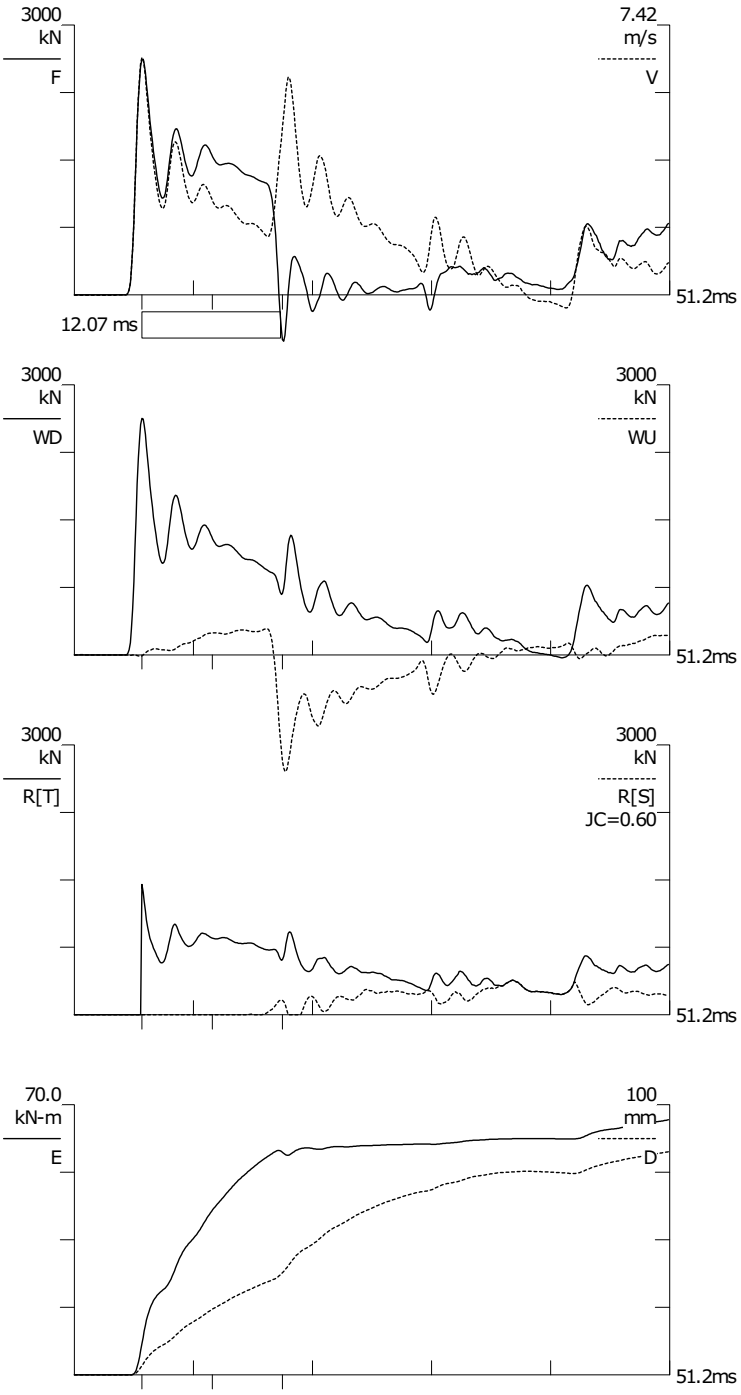
ZET1 0h

Junttan HHK 5A



BN 36/778
3.3.2015 11:55:54
FMX 2621 kN
RMX 301 kN
CSX 265.7 MPa
CSI 281.9 MPa
TSX 63.2 MPa
EMX 68.9 kN-m
VMX 6.52 m/s
DMX 90 mm
FVP 1.0 []

LE 30.9 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m
LP 30.0 m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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PDA OP: TRe

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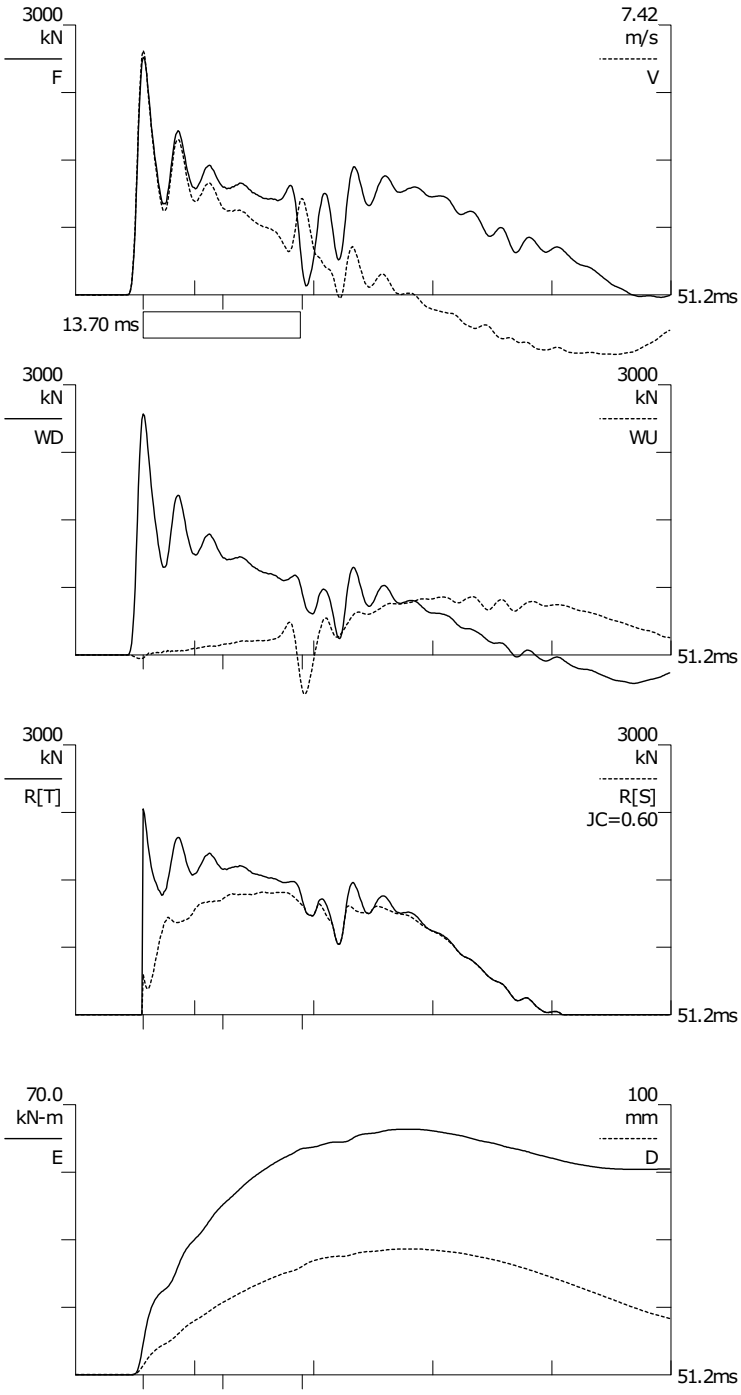
ZET2 0h

Junttan HHK 5A



BN 63/749
3.3.2015 9:06:40
FMX 2641 kN
RMX 1363 kN
CSX 267.8 MPa
CSI 297.4 MPa
TSX 33.5 MPa
EMX 63.7 kN-m
VMX 6.72 m/s
DMX 47 mm
FVP 1.0 []

LE 35.0 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m
LP 34.0 m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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Koepaalutus Zatelliitti

PDA OP: TRe

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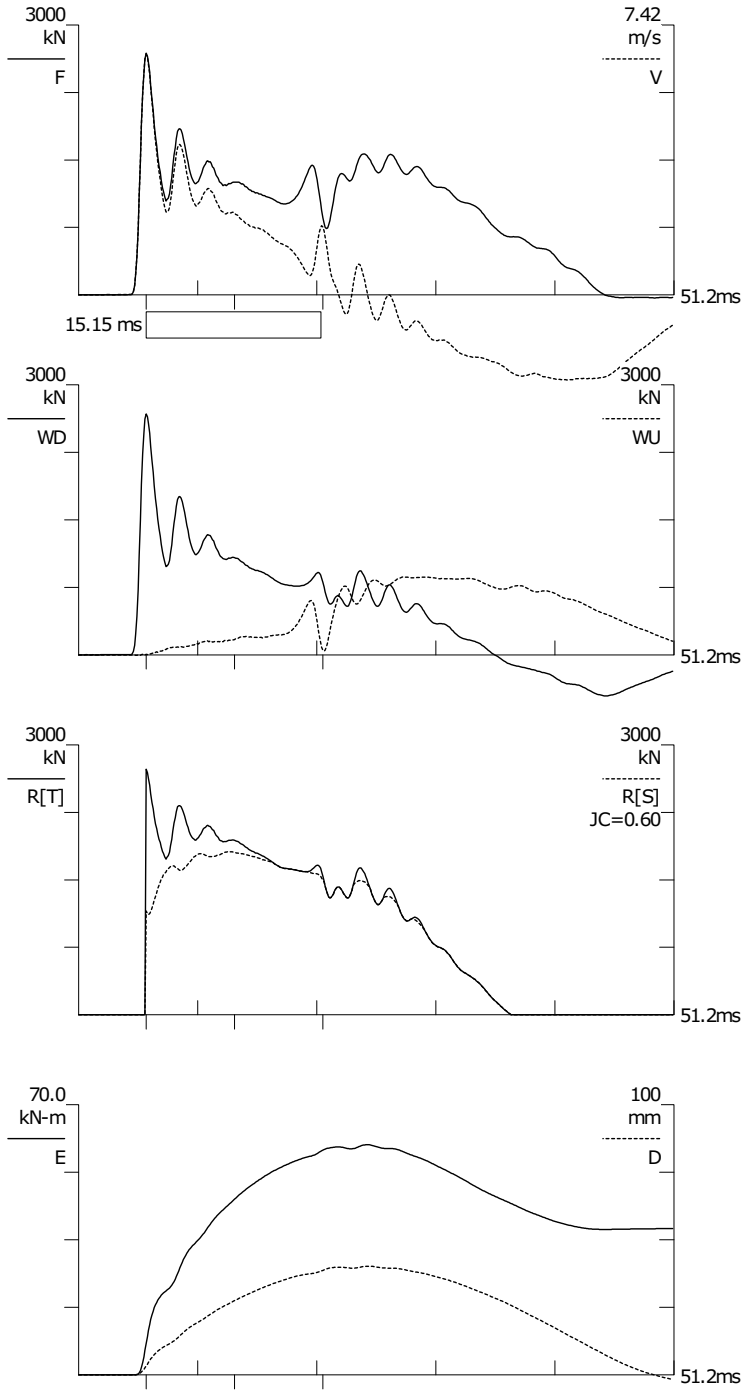
ZET3 0h

Junttan HHK 5A



BN 6/1886
3.3.2015 10:34:56
FMX 2687 kN
RMX 1814 kN
CSX 272.4 MPa
CSI 296.3 MPa
TSX 58.6 MPa
EMX 59.7 kN-m
VMX 6.61 m/s
DMX 40 mm
FVP 1.0 []

LE 38.8 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m
LP 38.0 m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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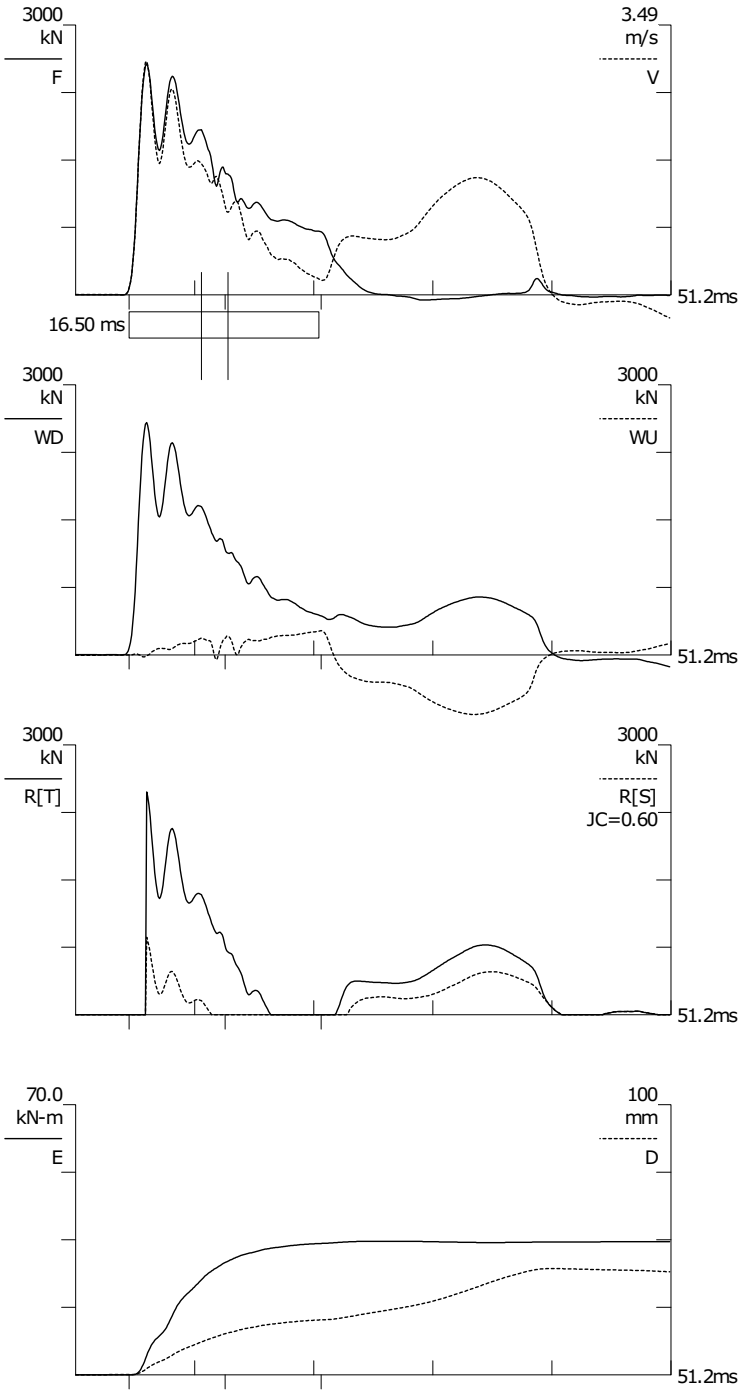
Koepaalutus Zatelliitti
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZEB1 0h
Junttan HHK 5A



BN 29/714
3.3.2015 16:50:12
FMX 2568 kN
RMX 864 kN
CSX 28.5 MPa
CSI 30.6 MPa
TSX 3.9 MPa
EMX 35.3 kN-m
VMX 3.02 m/s
DMX 39 mm
FVP 1.0 []

LE 31.0 m
AR 900.00 cm^2
EM 35849 MPa
SP 25.0 kN/m3
WS 3750.0 m/s
EA/C 860 kN-s/m
LP 30.0 m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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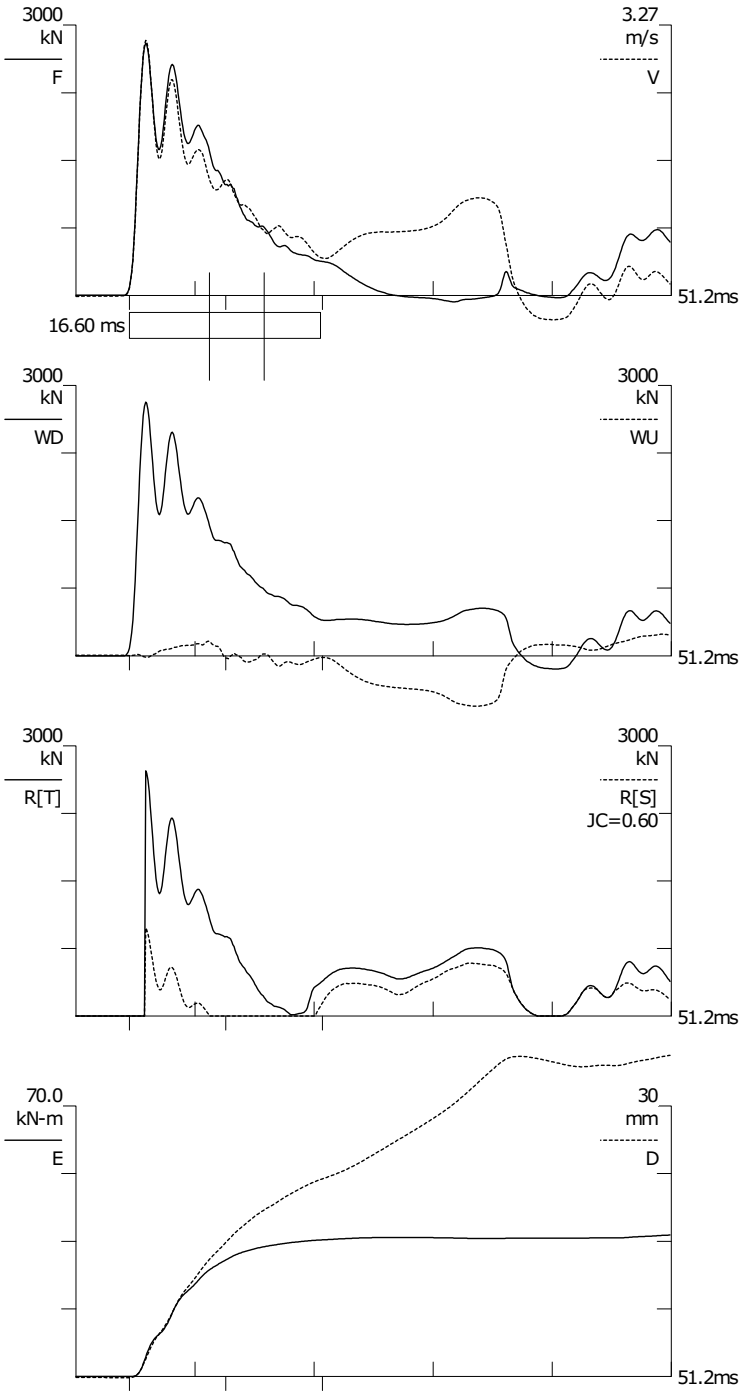
Koepaalutus Zatelliitti
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZEB2 0h
Junttan HHK 5A



BN 40/833
3.3.2015 16:23:45
FMX 2800 kN
RMX 977 kN
CSX 31.1 MPa
CSI 33.2 MPa
TSX 2.4 MPa
EMX 36.9 kN-m
VMX 3.08 m/s
DMX 36 mm
FVP 1.0 []

LE 27.5 m
AR 900.00 cm^2
EM 40789 MPa
SP 25.0 kN/m3
WS 4000.0 m/s
EA/C 918 kN-s/m
LP 35.0 m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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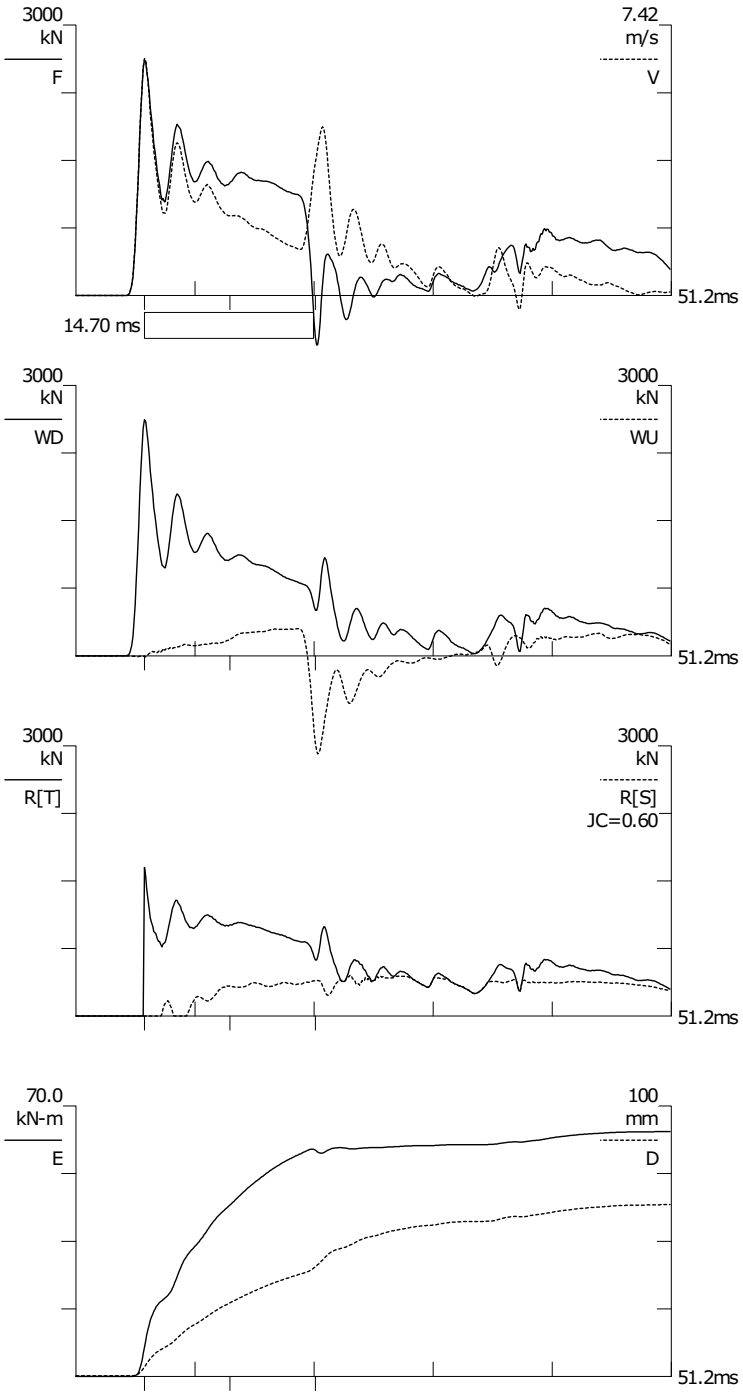
Koepaalutus Zatelliitti

PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053

ZPT4 0h

Junttan HHK 5A



BN 19/816
2.3.2015 12:09:58
FMX 2614 kN
RMX 454 kN
CSX 265.1 MPa
CSI 292.3 MPa
TSX 59.6 MPa
EMX 63.4 kN-m
VMX 6.50 m/s
DMX 64 mm
FVP 1.0 []

LE 37.7 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m
LP 37.0 m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [J601] 90 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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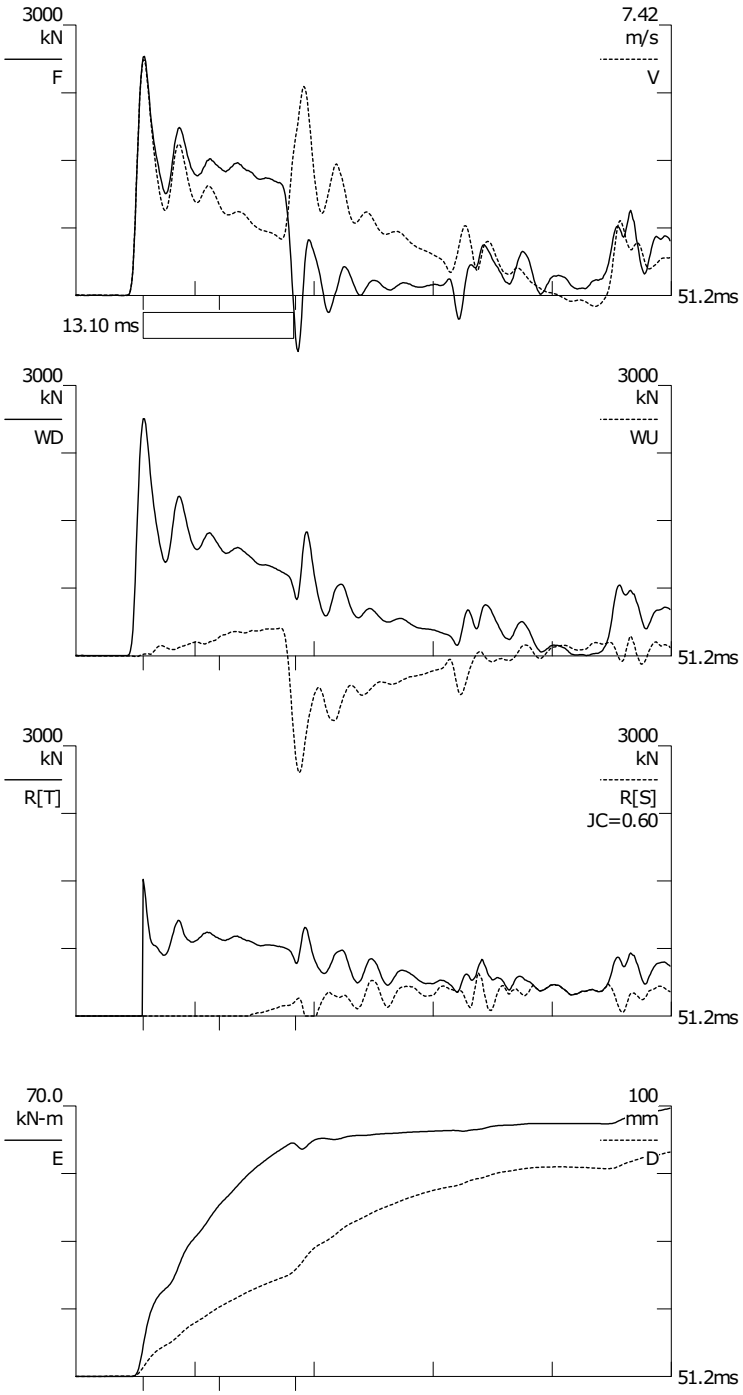
PILE DRIVING ANALYZER ®
Version 2009.098.053

Koepaalutus Zatelliitti
PDA OP: TRe

ZPT5 0h
Junttan HHK 5A



BN 1/729
2.3.2015 13:53:08
FMX 2654 kN
RMX 480 kN
CSX 269.1 MPa
CSI 278.1 MPa
TSX 68.3 MPa
EMX 74.2 kN-m
VMX 6.46 m/s
DMX 94 mm
FVP 1.0 []

LE 33.6 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m
LP 34.0 m

F34 A12

F3: [J372] 90.6 (1)
F4: [J601] 90 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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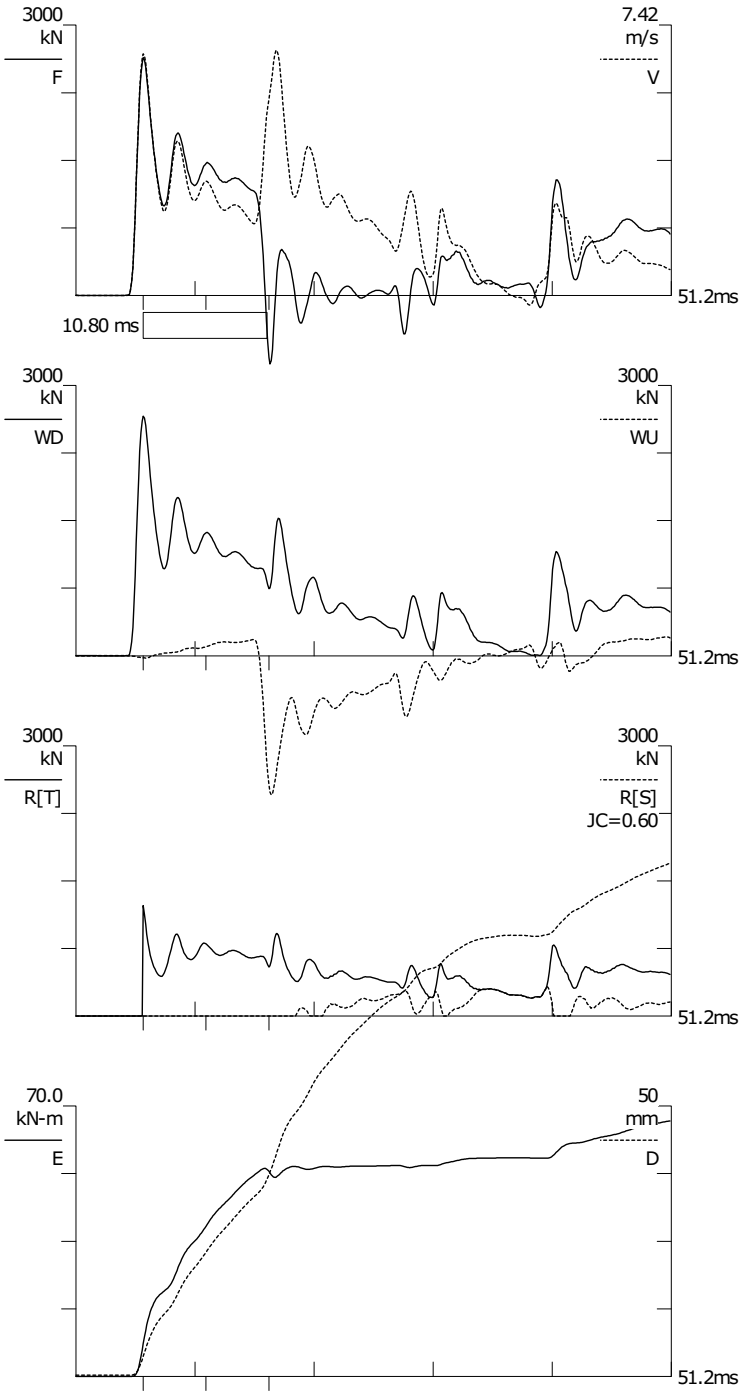
Koepaalutus Zatelliitti
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZPT6
Junttan HHK 5A



BN 2/501
2.3.2015 15:22:46
FMX 2638 kN
RMX 303 kN
CSX 267.5 MPa
CSI 295.2 MPa
TSX 81.0 MPa
EMX 68.9 kN-m
VMX 6.73 m/s
DMX 108 mm
FVP 1.0 []

LE 27.6 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m
LP 27.0 m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [J601] 90 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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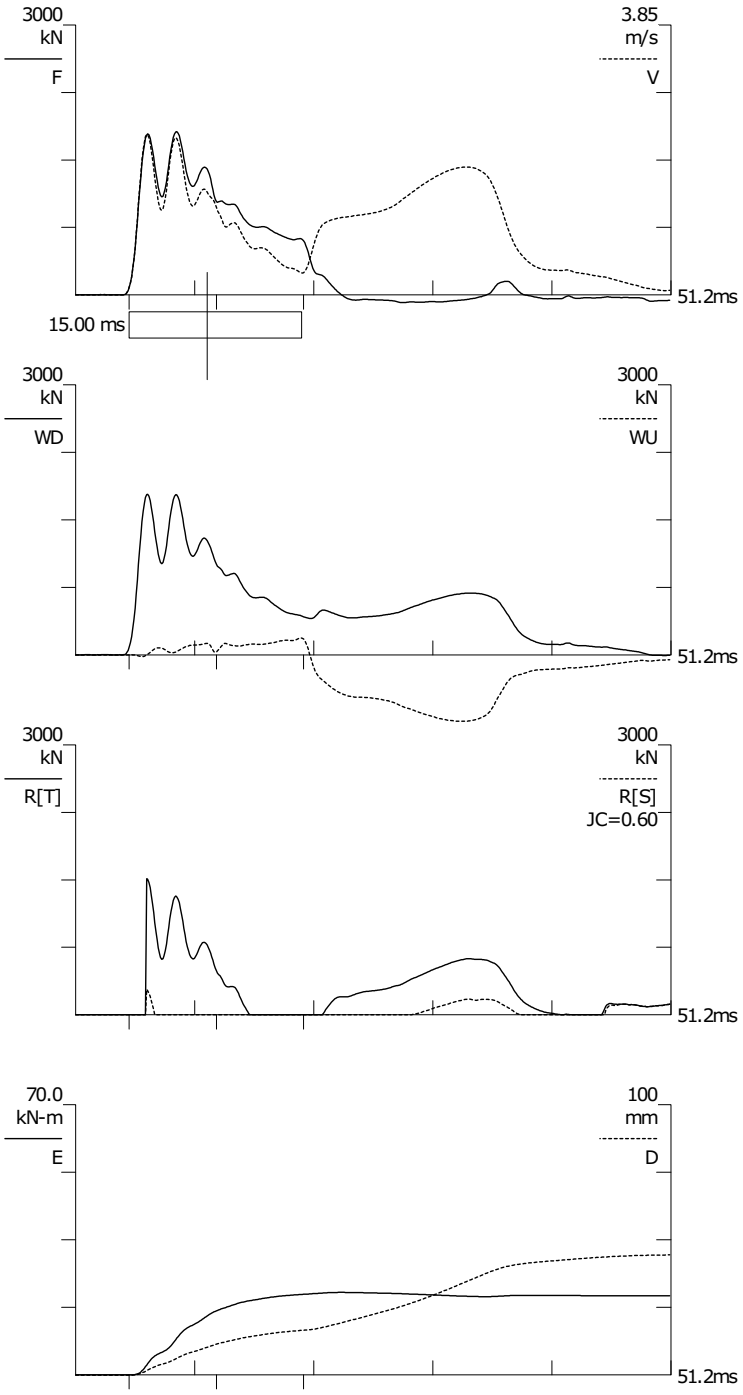
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053

ZPB3 0h

Junttan HHK 5A



BN 10/588
2.3.2015 17:30:56
FMX 1814 kN
RMX 283 kN
CSX 20.2 MPa
CSI 22.6 MPa
TSX 3.7 MPa
EMX 21.4 kN-m
VMX 2.28 m/s
DMX 46 mm
FVP 1.0 []

LE 27.5 m
AR 900.00 cm^2
EM 29470 MPa
SP 25.0 kN/m3
WS 3400.0 m/s
EA/C 780 kN-s/m
LP 27.0 m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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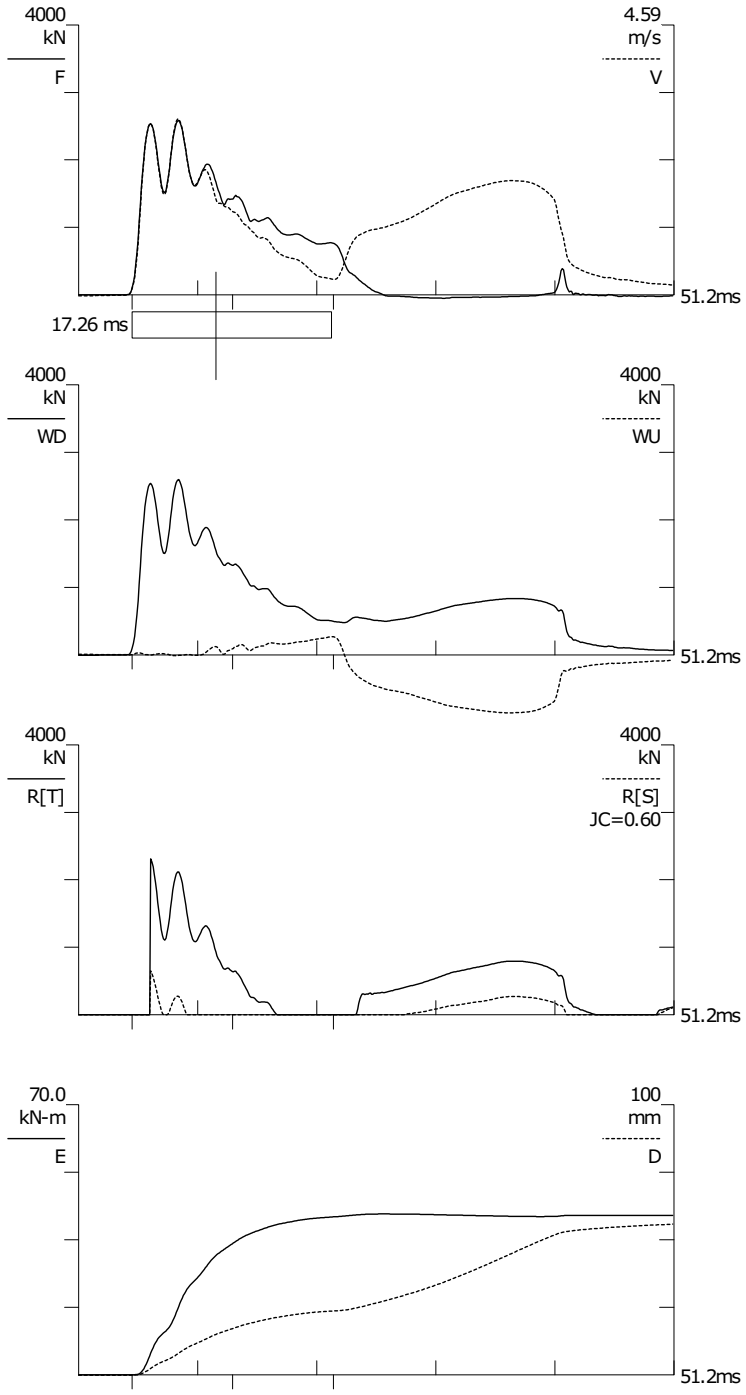
Koepaalutus Zatelliitti
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZPB4 0h
Junttan HHK 5A



BN 11/1038
2.3.2015 17:08:33
FMX 2588 kN
RMX 654 kN
CSX 28.8 MPa
CSI 33.2 MPa
TSX 4.2 MPa
EMX 41.7 kN-m
VMX 2.99 m/s
DMX 59 mm
FVP 1.0 []

LE 32.8 m
AR 900.00 cm^2
EM 36812 MPa
SP 25.0 kN/m3
WS 3800.0 m/s
EA/C 872 kN-s/m
LP 32.0 m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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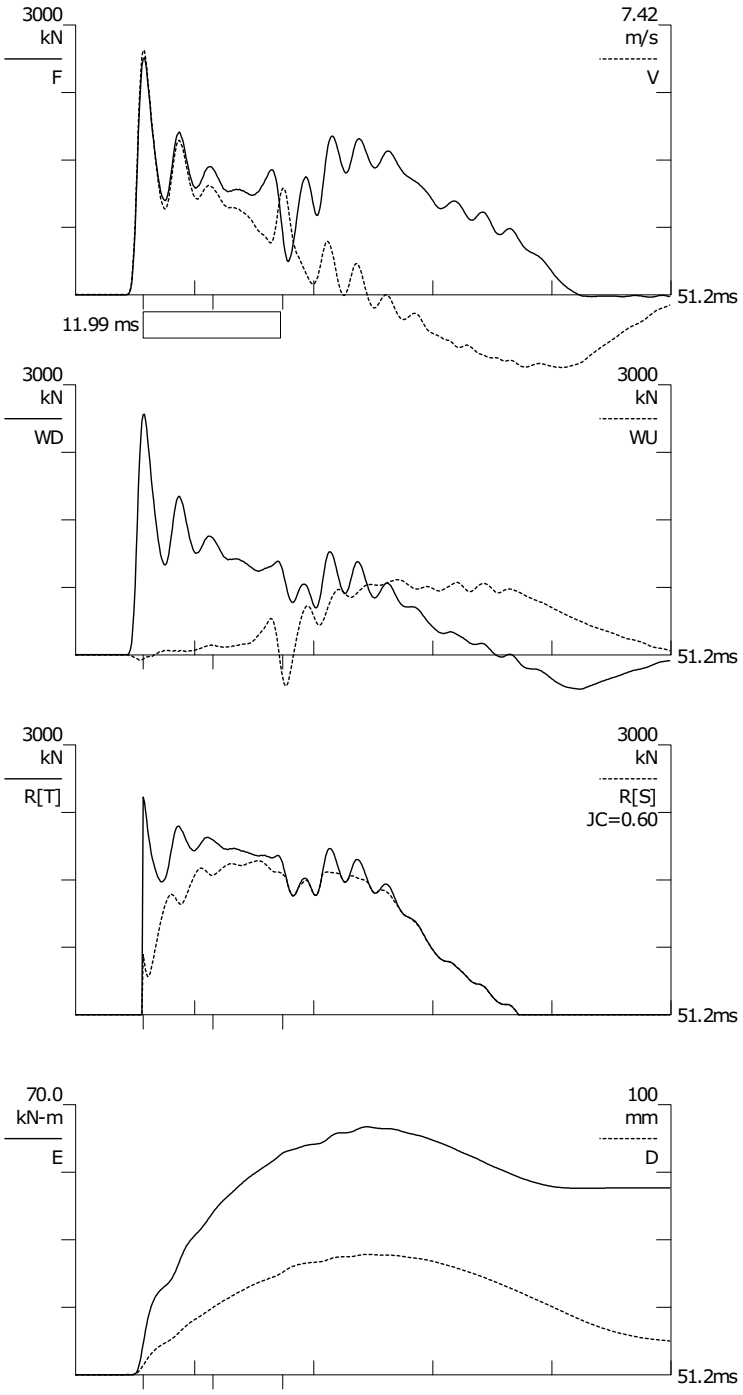
Koepaalutus Tuuliharju
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-T1 0h
Junttan HHK 5A



BN 84/828
4.3.2015 9:23:47
FMX 2635 kN
RMX 1711 kN
CSX 267.2 MPa
CSI 284.1 MPa
TSX 46.9 MPa
EMX 64.3 kN-m
VMX 6.72 m/s
DMX 45 mm
FVP 1.0 []

LE 30.7 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m
LP 27.0 m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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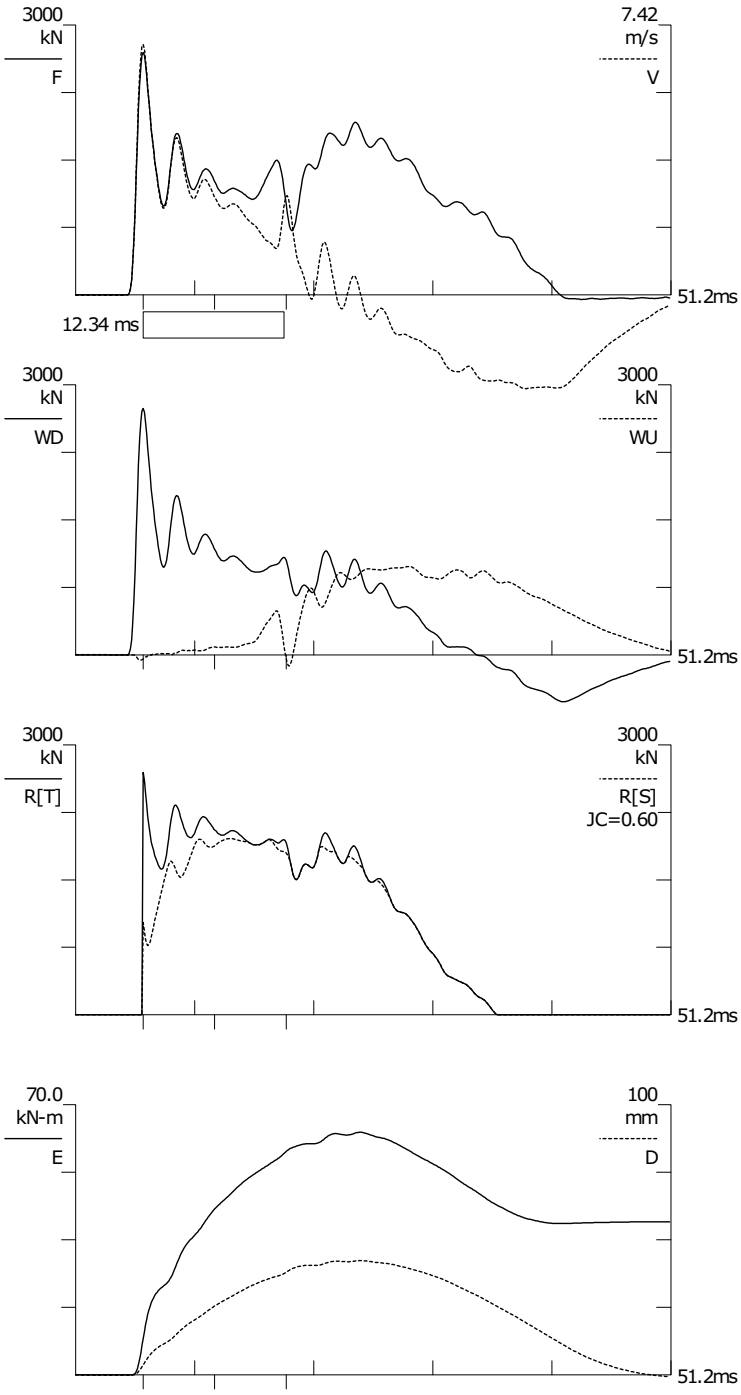
Koepaalutus Tuuliharju

PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053

TU-T2 0h

Junttan HHK 5A



BN 227/1094
4.3.2015 10:57:35
FMX 2692 kN
RMX 1958 kN
CSX 272.9 MPa
CSI 286.2 MPa
TSX 63.4 MPa
EMX 62.9 kN-m
VMX 6.88 m/s
DMX 42 mm
FVP 1.0 []

LE 31.6 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m
LP 25.0 m

F1234 A2

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A2: [45901] 1150 g's/v (1)

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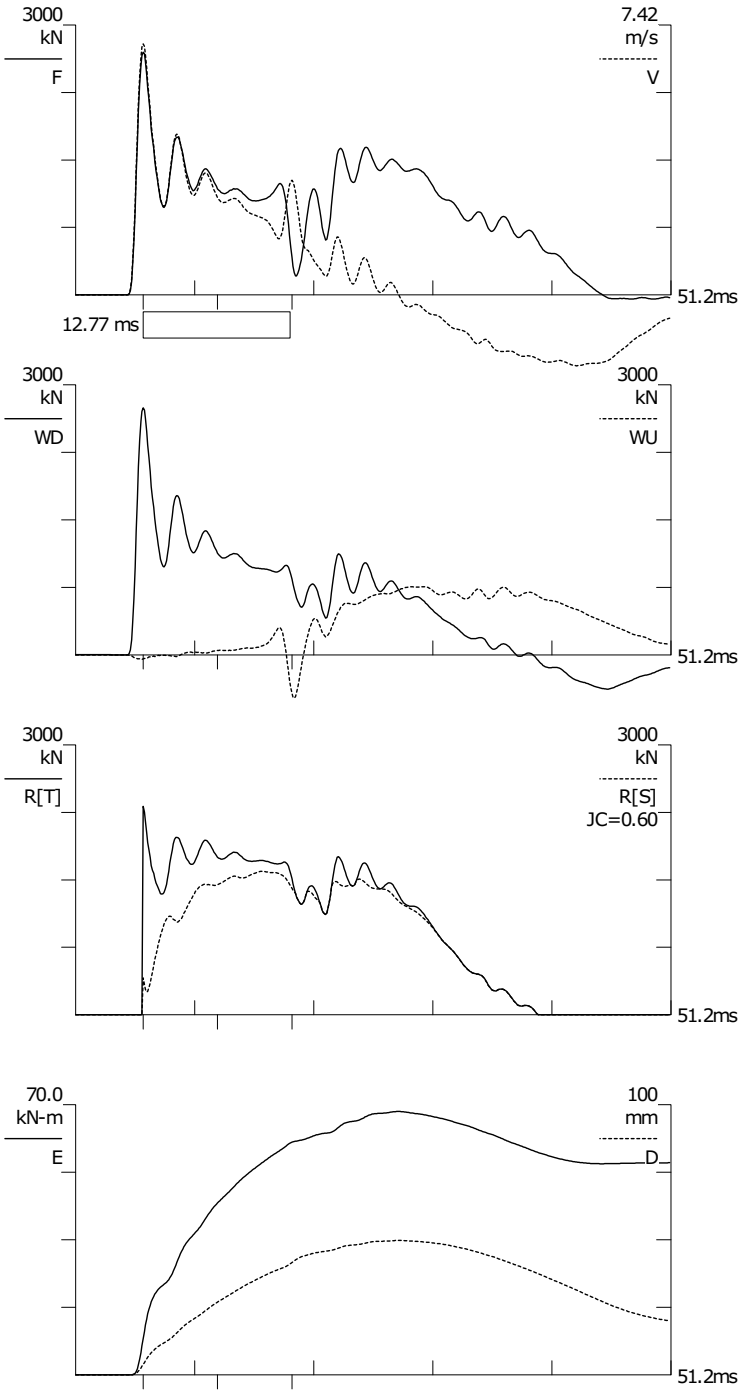
Koepaalutus Tuuliharju
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-T3 0h
Junttan HHK 5A



BN 1/848
4.3.2015 13:05:42
FMX 2699 kN
RMX 1595 kN
CSX 273.7 MPa
CSI 313.6 MPa
TSX 49.9 MPa
EMX 68.3 kN-m
VMX 6.90 m/s
DMX 50 mm
FVP 1.0 []

LE 32.7 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m
LP 25.0 m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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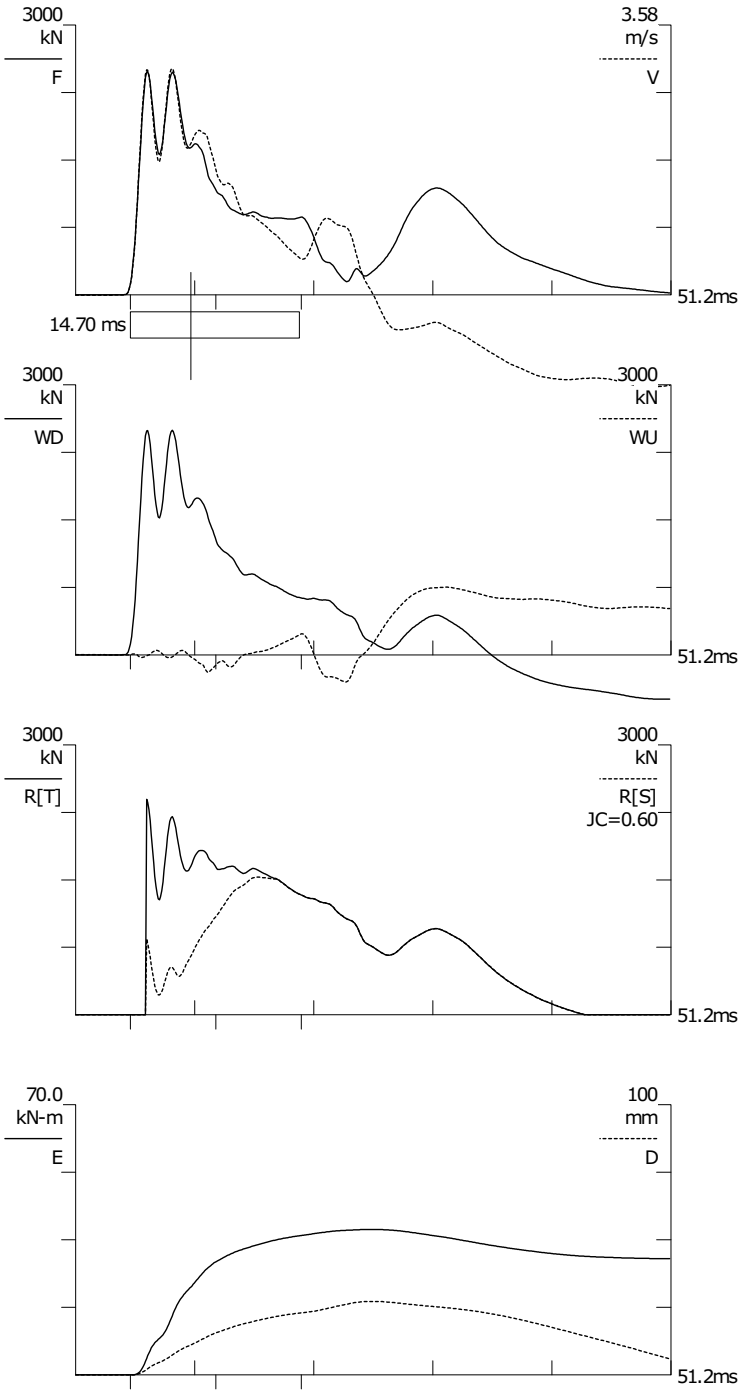
Koepaalutus Tuuliharju
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-B1 0h
Junttan HHK 5A



BN 248/721
4.3.2015 14:33:49
FMX 2485 kN
RMX 1530 kN
CSX 27.6 MPa
CSI 29.4 MPa
TSX 3.0 MPa
EMX 37.7 kN-m
VMX 3.01 m/s
DMX 27 mm
FVP 1.0 []

LE 25.9 m
AR 900.00 cm^2
EM 33963 MPa
SP 25.0 kN/m3
WS 3650.0 m/s
EA/C 837 kN-s/m
LP 24.0 m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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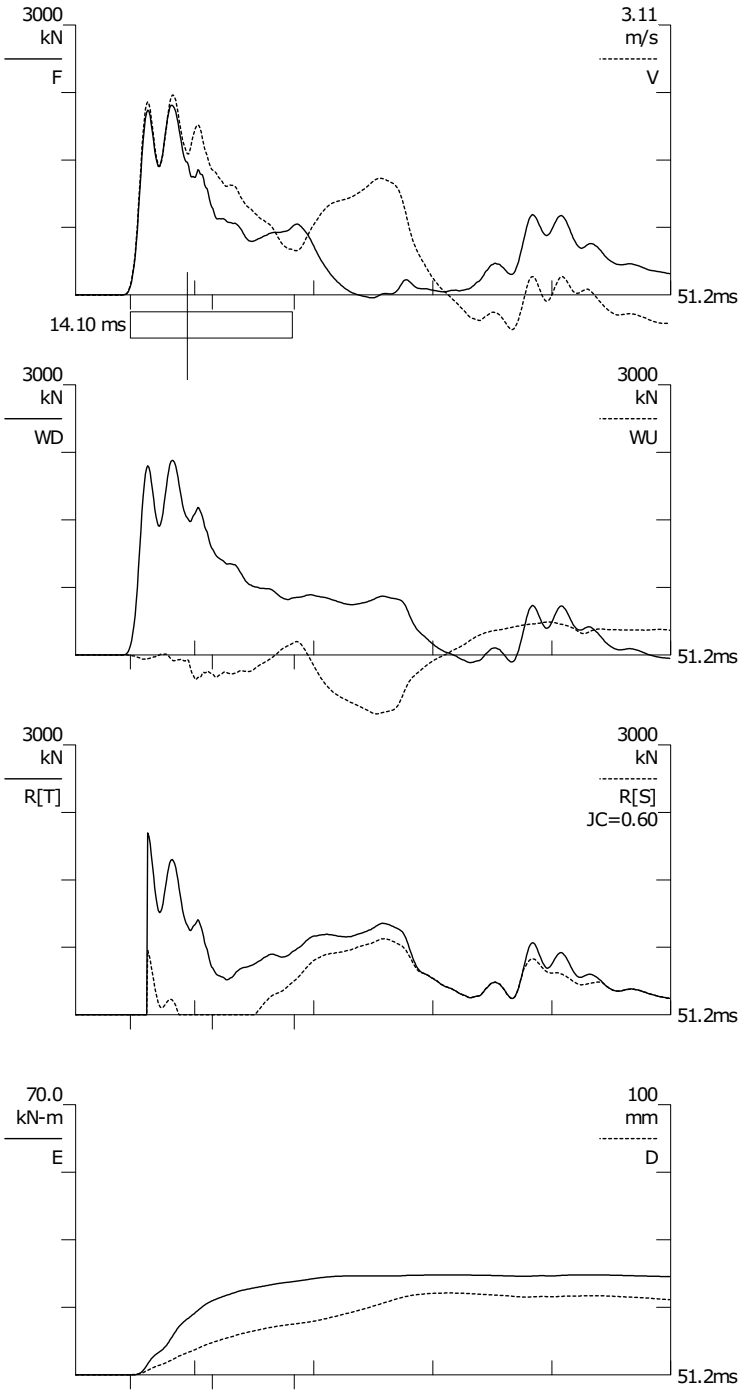
Koepaalutus Tuuliharju
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-B2 0h
Junttan HHK 5A



BN 1/356
4.3.2015 15:02:45
FMX 2107 kN
RMX 847 kN
CSX 23.4 MPa
CSI 28.8 MPa
TSX 1.2 MPa
EMX 25.9 kN-m
VMX 2.31 m/s
DMX 30 mm
FVP 1.0 []

LE 24.0 m
AR 900.00 cm^2
EM 44969 MPa
SP 25.0 kN/m3
WS 4200.0 m/s
EA/C 964 kN-s/m
LP 24.0 m

F12 A12

F1: [J583] 92 (1.05)
F2: [J931] 91.2 (1.05)
A1: [45900] 1160 g's/v (0.95)
A2: [45901] 1150 g's/v (0.95)

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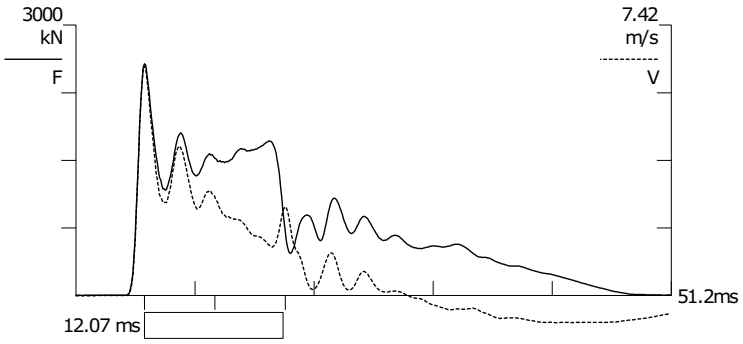
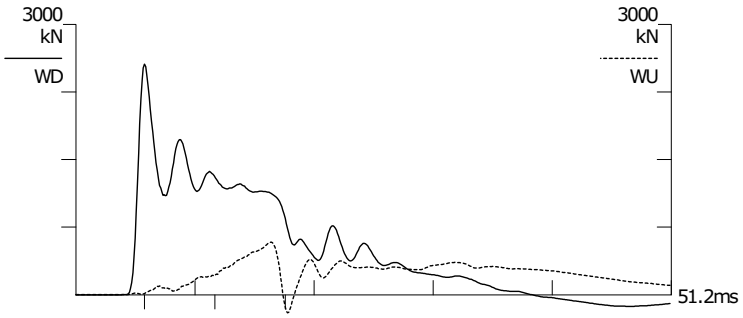
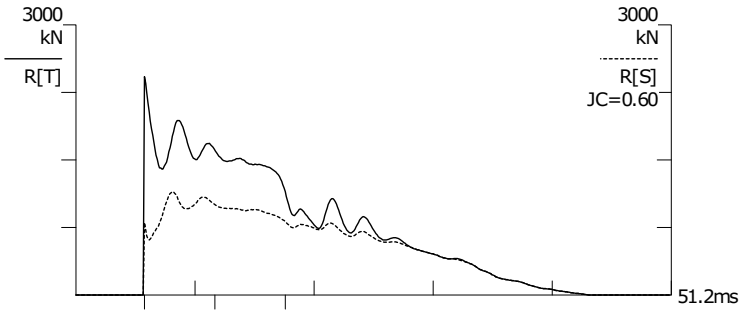
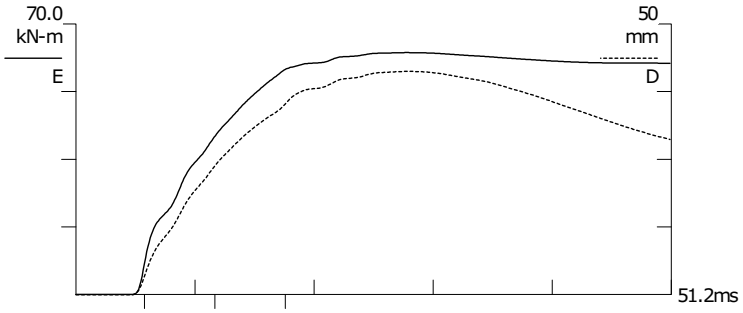
Koepaalutus Zatelliitti
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZET1 24h
Junttan HHK 5A









BN 35
4.3.2015 16:51:05
FMX 2573 kN
RMX 1148 kN
CSX 260.9 MPa
CSI 323.9 MPa
TSX 4.0 MPa
EMX 62.6 kN-m
VMX 6.30 m/s
DMX 41 mm
FVP 1.0 []

LE 30.9 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F1234 A1

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)

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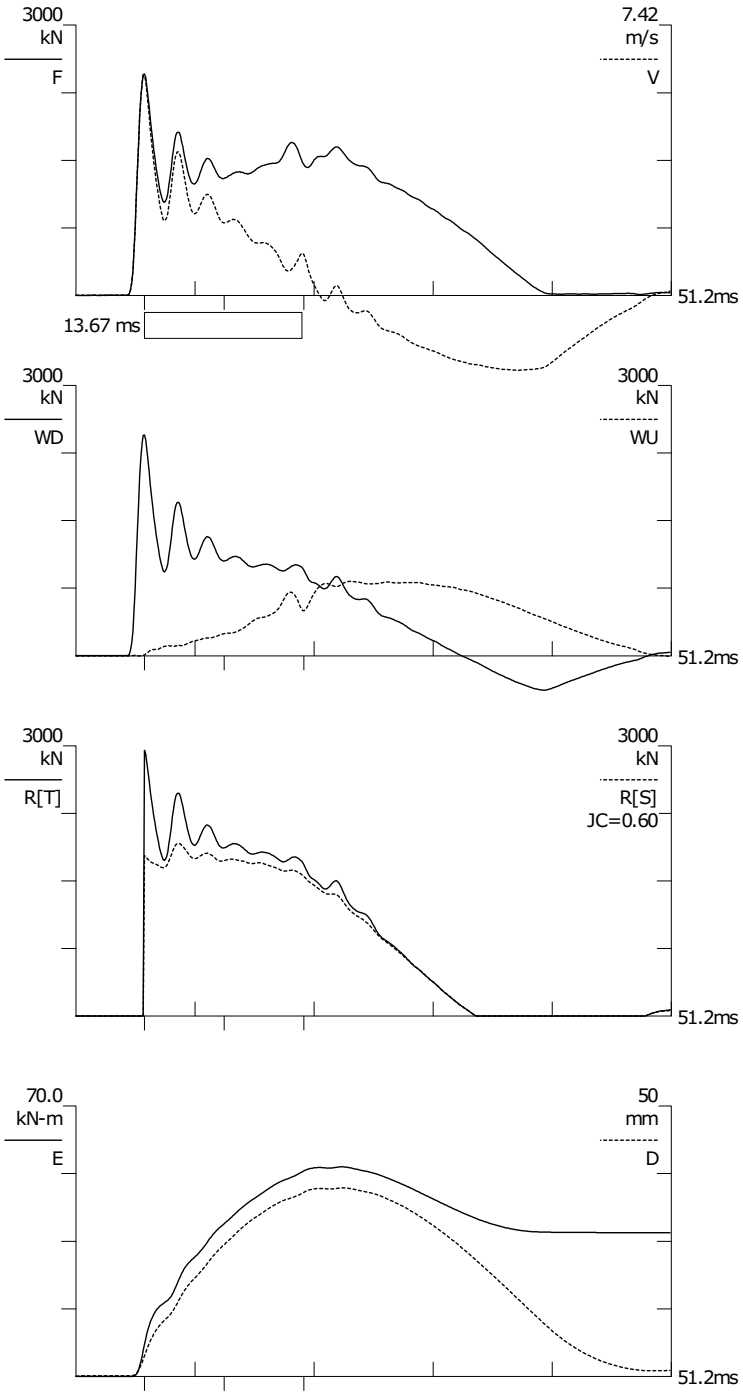
Koepaalutus Zatelliitti
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZET2 24h
Junttan HHK 5A



BN 14
4.3.2015 16:36:17
FMX 2459 kN
RMX 1917 kN
CSX 249.3 MPa
CSI 259.3 MPa
TSX 43.3 MPa
EMX 54.3 kN-m
VMX 6.04 m/s
DMX 35 mm
FVP 1.0 []

LE 35.0 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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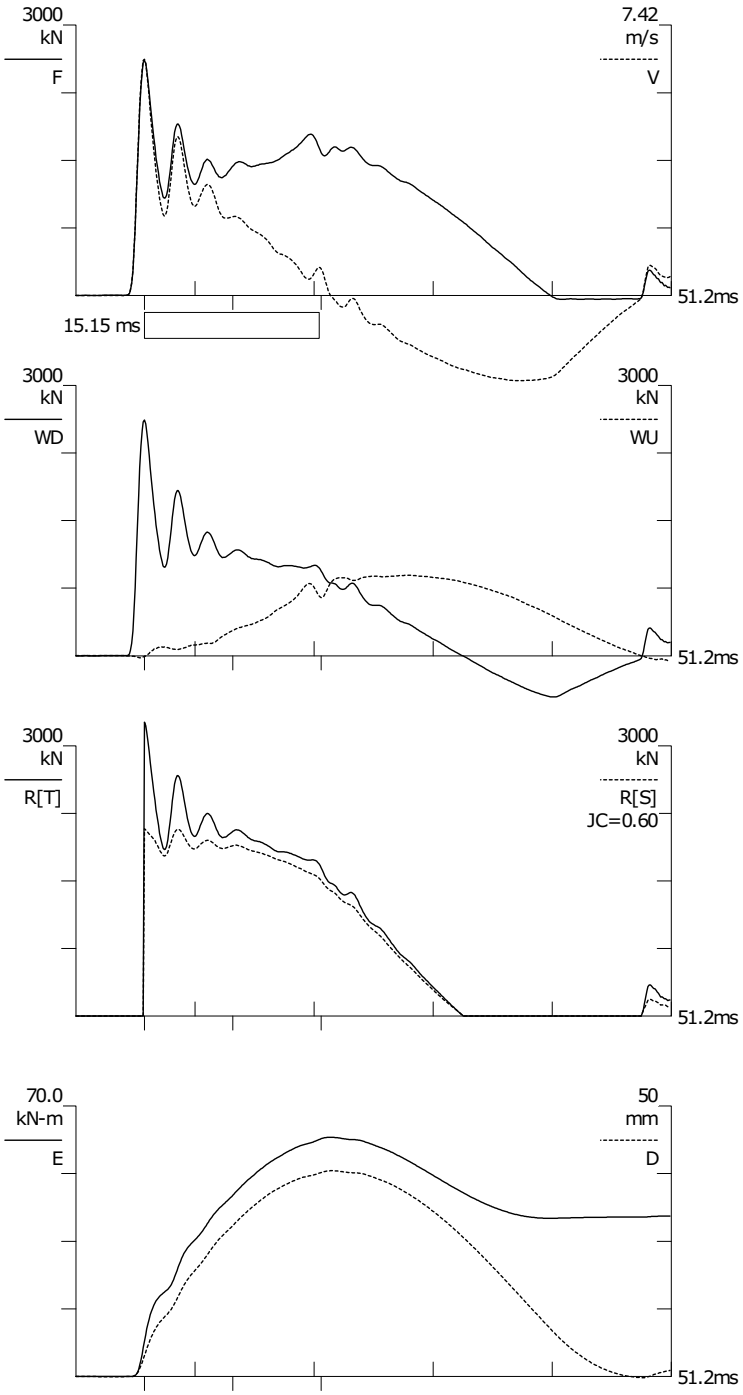
Koepaalutus Zatelliitti
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZET3 24h
Junttan HHK 5A



BN 21
4.3.2015 16:16:35
FMX 2608 kN
RMX 2078 kN
CSX 264.5 MPa
CSI 285.2 MPa
TSX 60.9 MPa
EMX 61.9 kN-m
VMX 6.49 m/s
DMX 38 mm
FVP 1.0 []

LE 38.8 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m
LP 0.3 m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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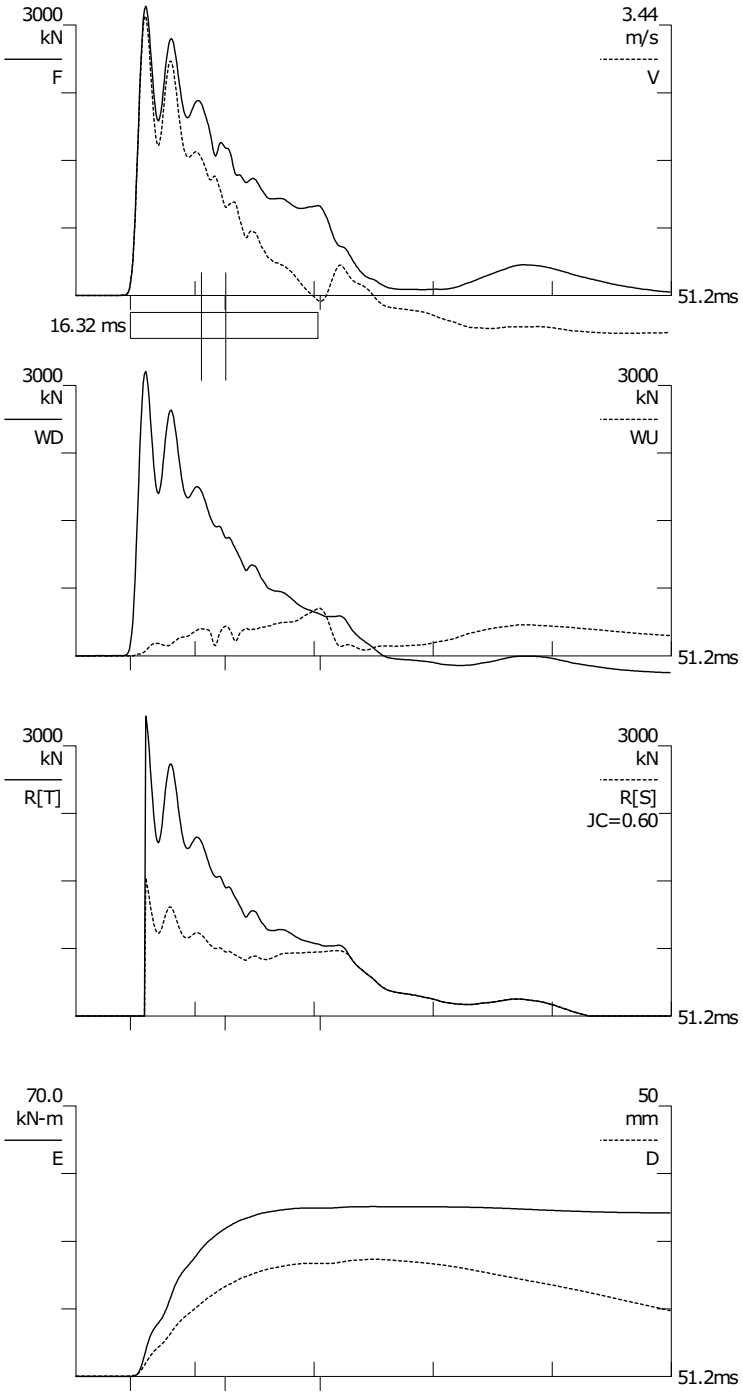
Koepaalutus Zatelliitti
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZEB1 24h
Junttan HHK 5A



BN 15
4.3.2015 15:59:01
FMX 3212 kN
RMX 1537 kN
CSX 35.7 MPa
CSI 37.6 MPa
TSX 1.7 MPa
EMX 44.0 kN-m
VMX 3.56 m/s
DMX 22 mm
FVP 1.0 []

LE 31.0 m
AR 900.00 cm^2
EM 36812 MPa
SP 25.0 kN/m3
WS 3800.0 m/s
EA/C 872 kN-s/m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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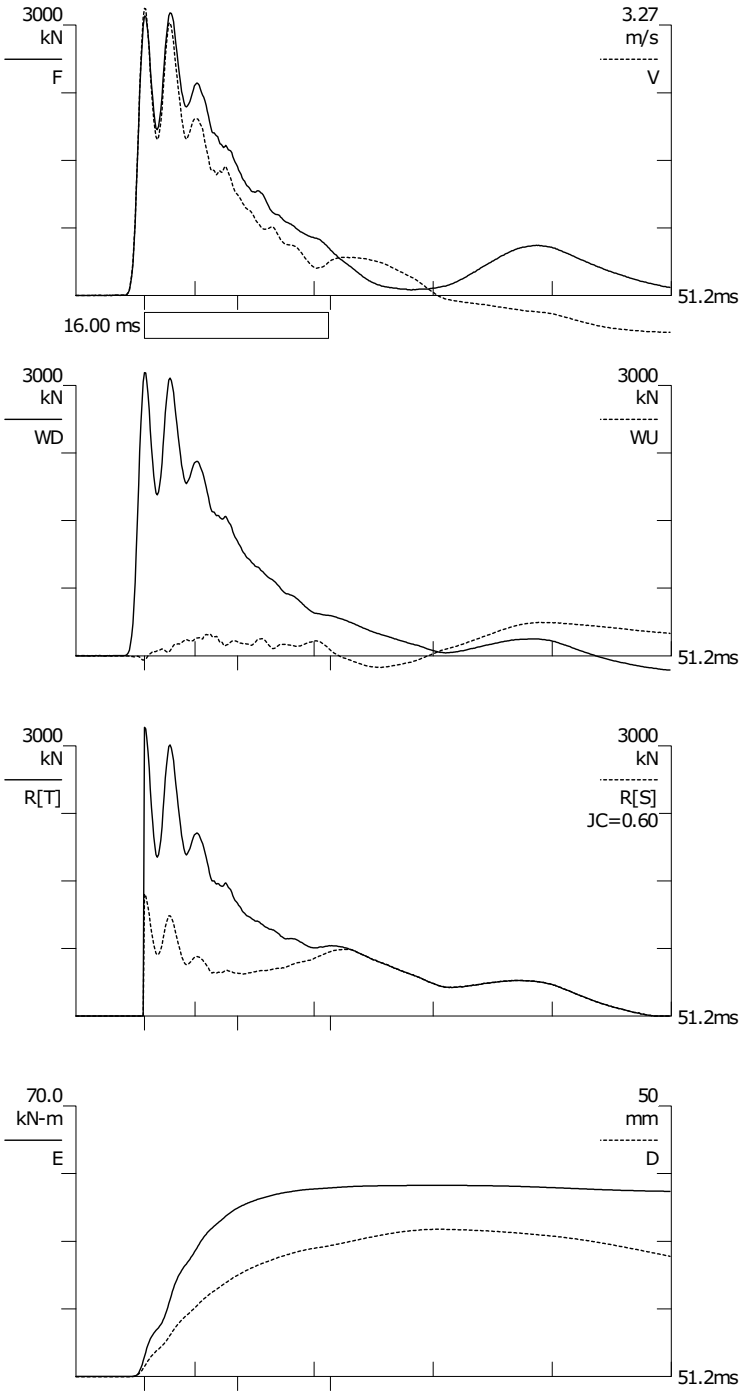
Koepaalutus Zatelliitti
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZEB2 24h
Junttan HHK 5A



BN 5
4.3.2015 15:47:25
FMX 3138 kN
RMX 1356 kN
CSX 34.9 MPa
CSI 39.9 MPa
TSX 0.8 MPa
EMX 49.5 kN-m
VMX 3.47 m/s
DMX 27 mm
FVP 1.0 []

LE 29.5 m
AR 900.00 cm^2
EM 40789 MPa
SP 25.0 kN/m3
WS 4000.0 m/s
EA/C 918 kN-s/m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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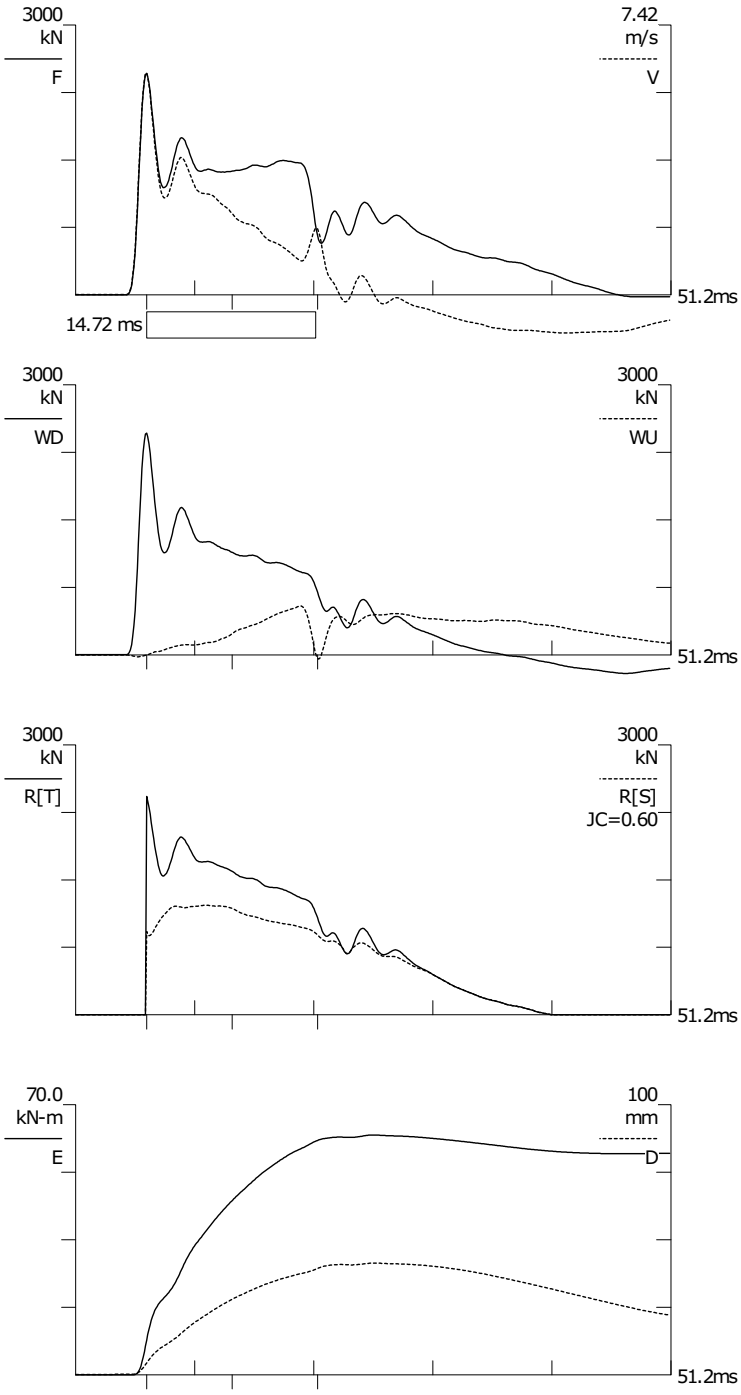
Koepaalutus Zatelliitti
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZPT4 24h
Junttan HHK 5A



BN 14
3.3.2015 12:48:19
FMX 2462 kN
RMX 1217 kN
CSX 249.7 MPa
CSI 318.2 MPa
TSX 13.4 MPa
EMX 62.2 kN-m
VMX 6.10 m/s
DMX 41 mm
FVP 1.0 []

LE 37.7 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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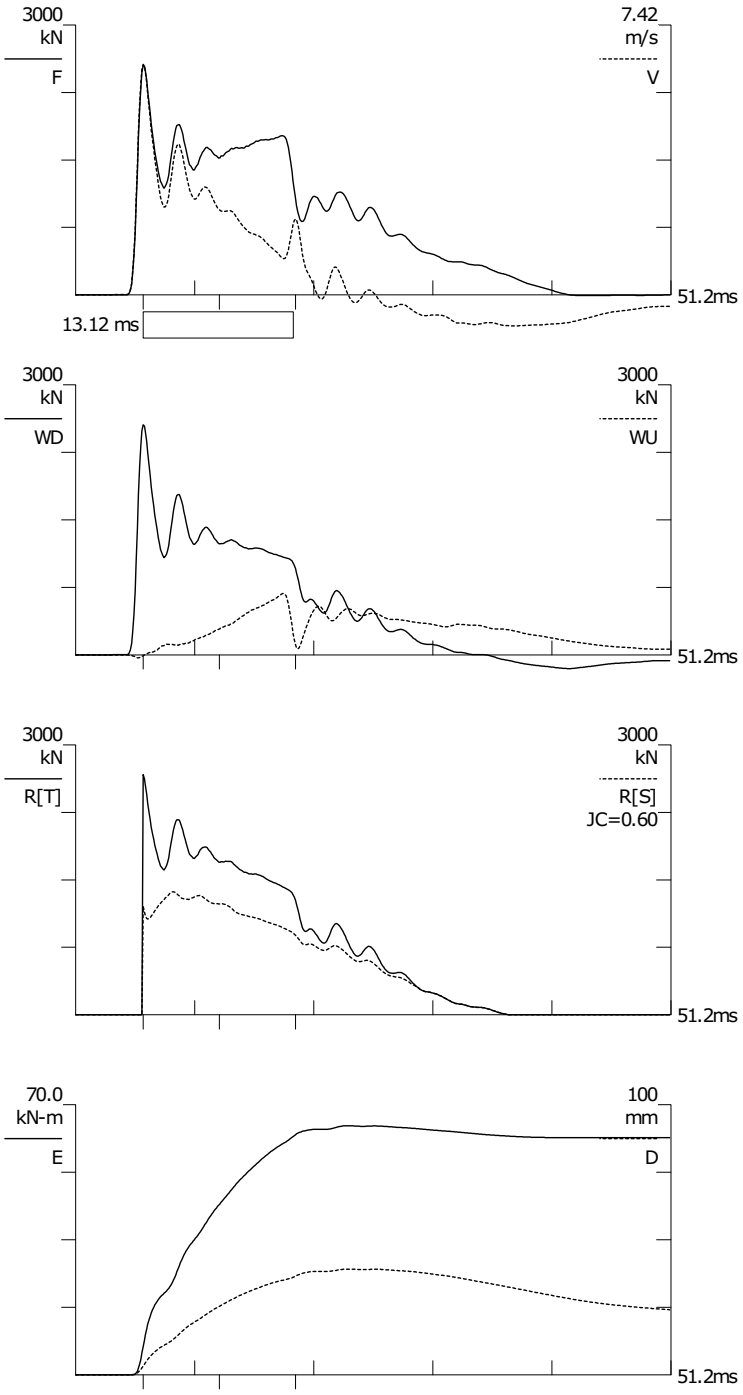
Koepaalutus Zatelliitti

PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053

ZPT5 24h

Junttan HHK 5A



BN 16
3.3.2015 12:33:02
FMX 2549 kN
RMX 1366 kN
CSX 258.5 MPa
CSI 277.2 MPa
TSX 9.5 MPa
EMX 64.6 kN-m
VMX 6.34 m/s
DMX 39 mm
FVP 1.0 []

LE 33.6 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

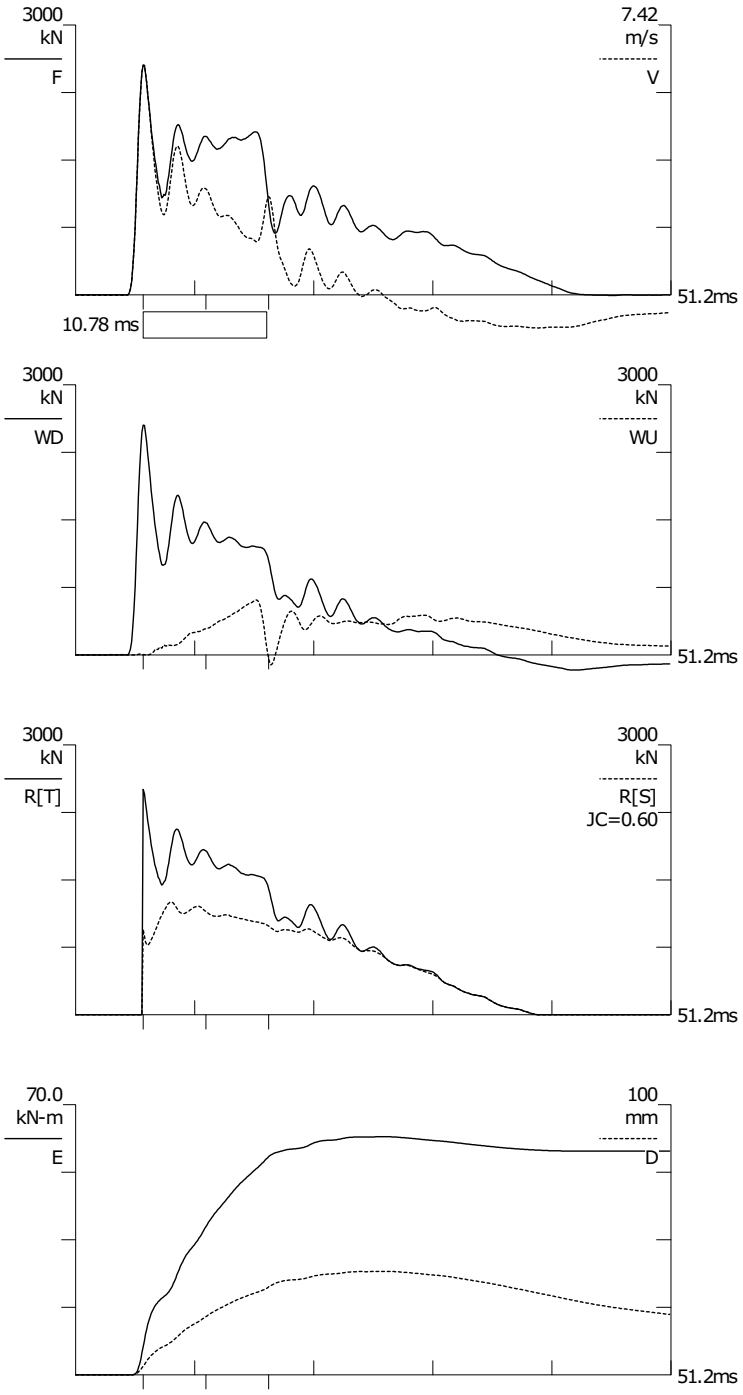
F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

Tampere University of Technology

Koepaalutus Zatelliitti
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZPT6 24h
Junttan HHK 5A



BN 18
3.3.2015 12:14:49
FMX 2555 kN
RMX 1253 kN
CSX 259.1 MPa
CSI 284.4 MPa
TSX 8.2 MPa
EMX 61.7 kN-m
VMX 6.31 m/s
DMX 38 mm
FVP 1.0 []

LE 27.6 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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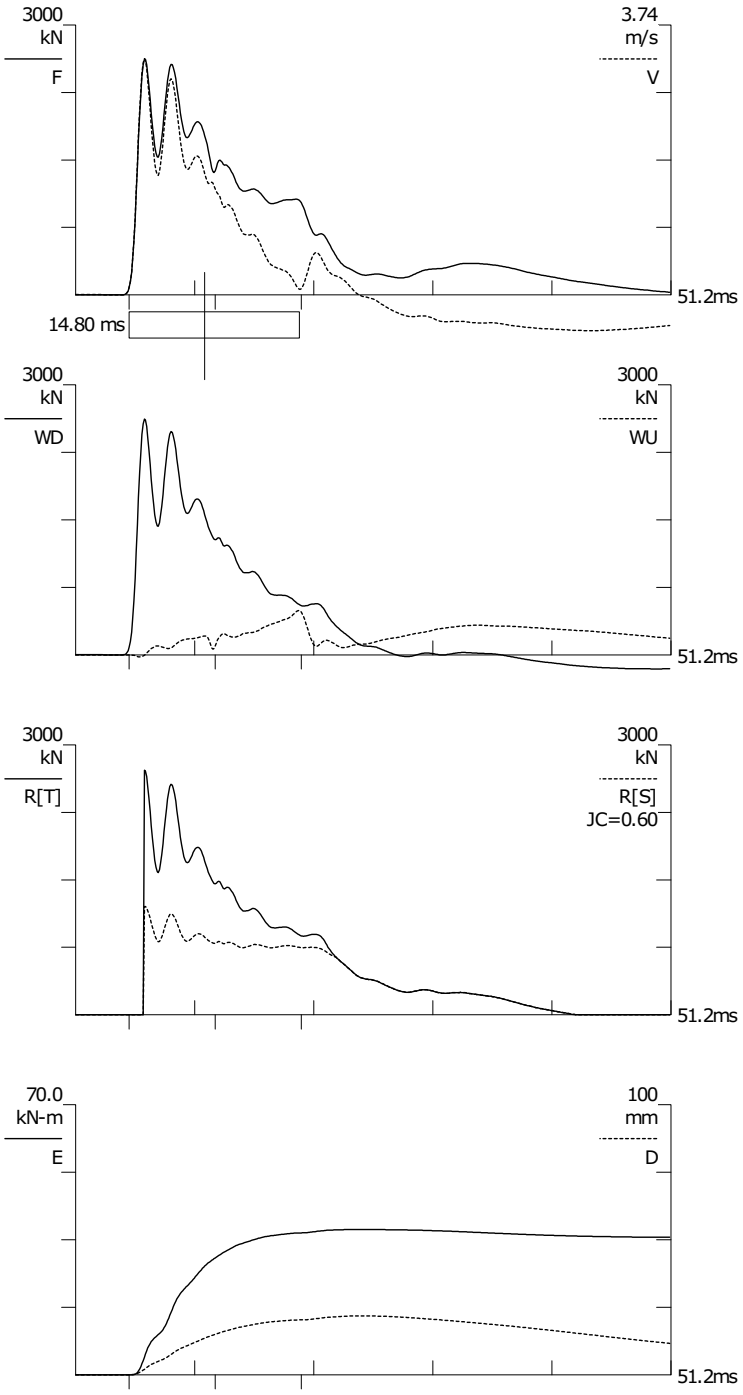
Koepaalutus Zatelliitti
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZPB3 24h
Junttan HHK 5A



BN 7
3.3.2015 14:24:18
FMX 2618 kN
RMX 1203 kN
CSX 29.1 MPa
CSI 30.3 MPa
TSX 0.7 MPa
EMX 37.7 kN-m
VMX 3.27 m/s
DMX 22 mm
FVP 1.0 []

LE 27.5 m
AR 900.00 cm^2
EM 31229 MPa
SP 25.0 kN/m3
WS 3500.0 m/s
EA/C 803 kN-s/m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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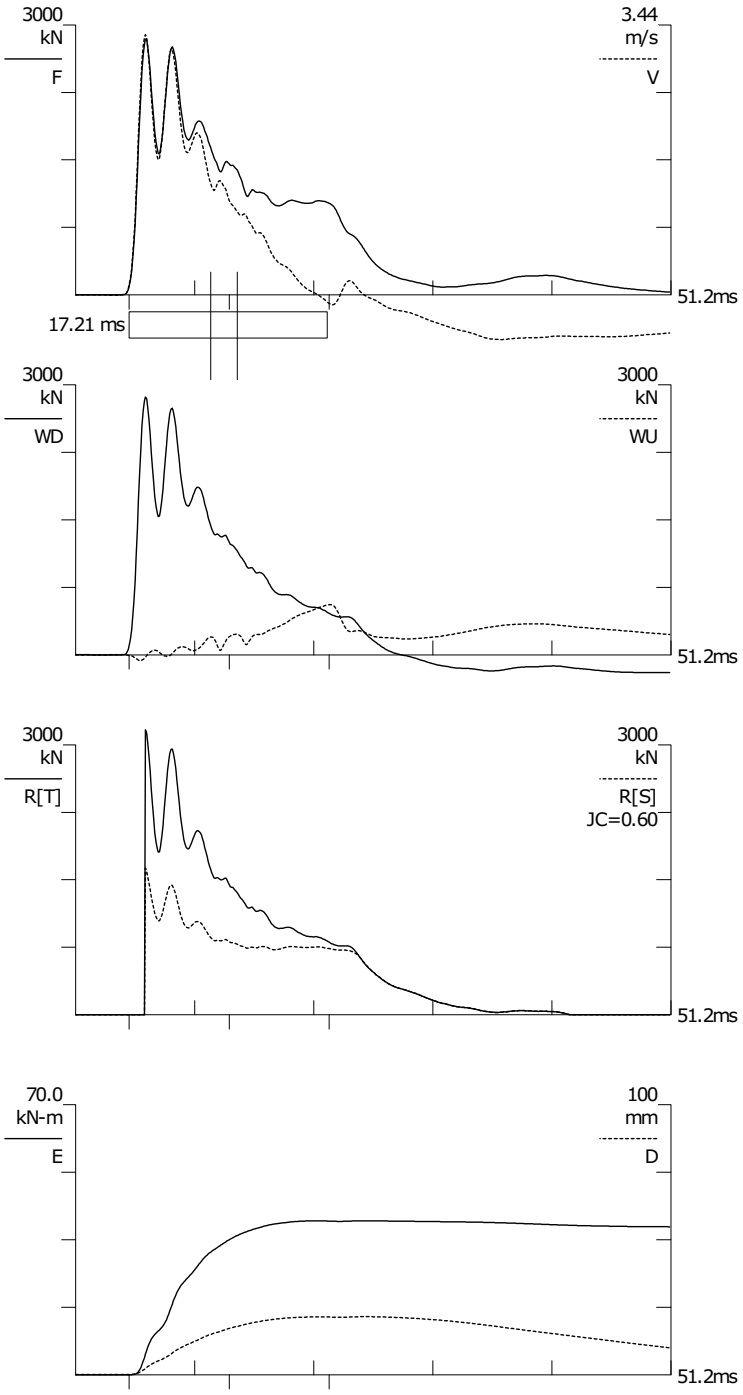
Koepaalutus Zatelliitti
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZPB4 24h
Junttan HHK 5A



BN 14
3.3.2015 14:46:11
FMX 2842 kN
RMX 1629 kN
CSX 31.6 MPa
CSI 35.7 MPa
TSX 1.4 MPa
EMX 39.9 kN-m
VMX 3.32 m/s
DMX 22 mm
FVP 1.0 []

LE 32.7 m
AR 900.00 cm^2
EM 36812 MPa
SP 25.0 kN/m3
WS 3800.0 m/s
EA/C 872 kN-s/m

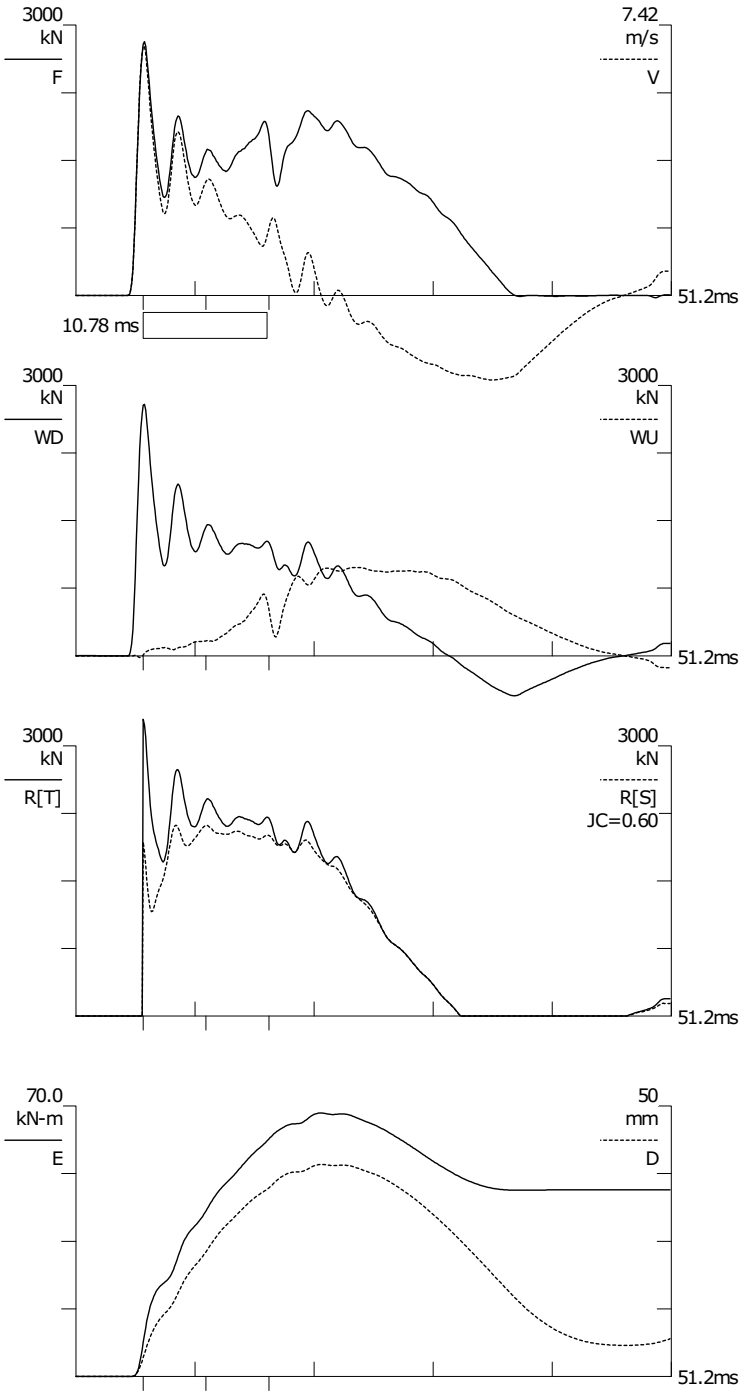
F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

Tampere University of Technology

Koepaalutus Tuuliharju
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-T1 24h
Junttan HHK 5A



BN 9
5.3.2015 11:02:54
FMX 2817 kN
RMX 2119 kN
CSX 285.7 MPa
CSI 298.2 MPa
TSX 48.2 MPa
EMX 68.2 kN-m
VMX 6.85 m/s
DMX 39 mm
FVP 1.0 []

LE 27.6 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

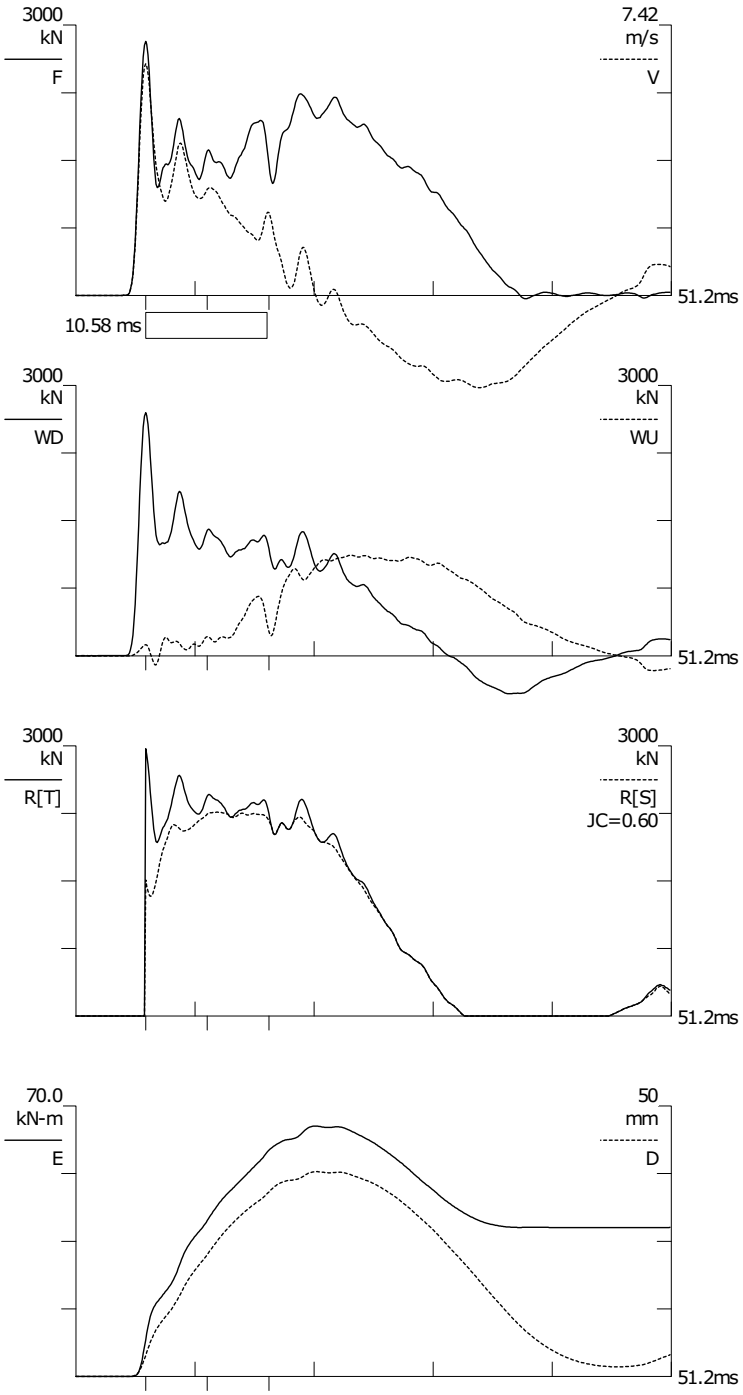
F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

Tampere University of Technology

Koepaalutus Tuuliharju
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-T2 24h
Junttan HHK 5A



BN 9
5.3.2015 10:55:09
FMX 2822 kN
RMX 2265 kN
CSX 286.2 MPa
CSI 315.4 MPa
TSX 45.5 MPa
EMX 64.8 kN-m
VMX 6.36 m/s
DMX 38 mm
FVP 1.1 []

LE 27.1 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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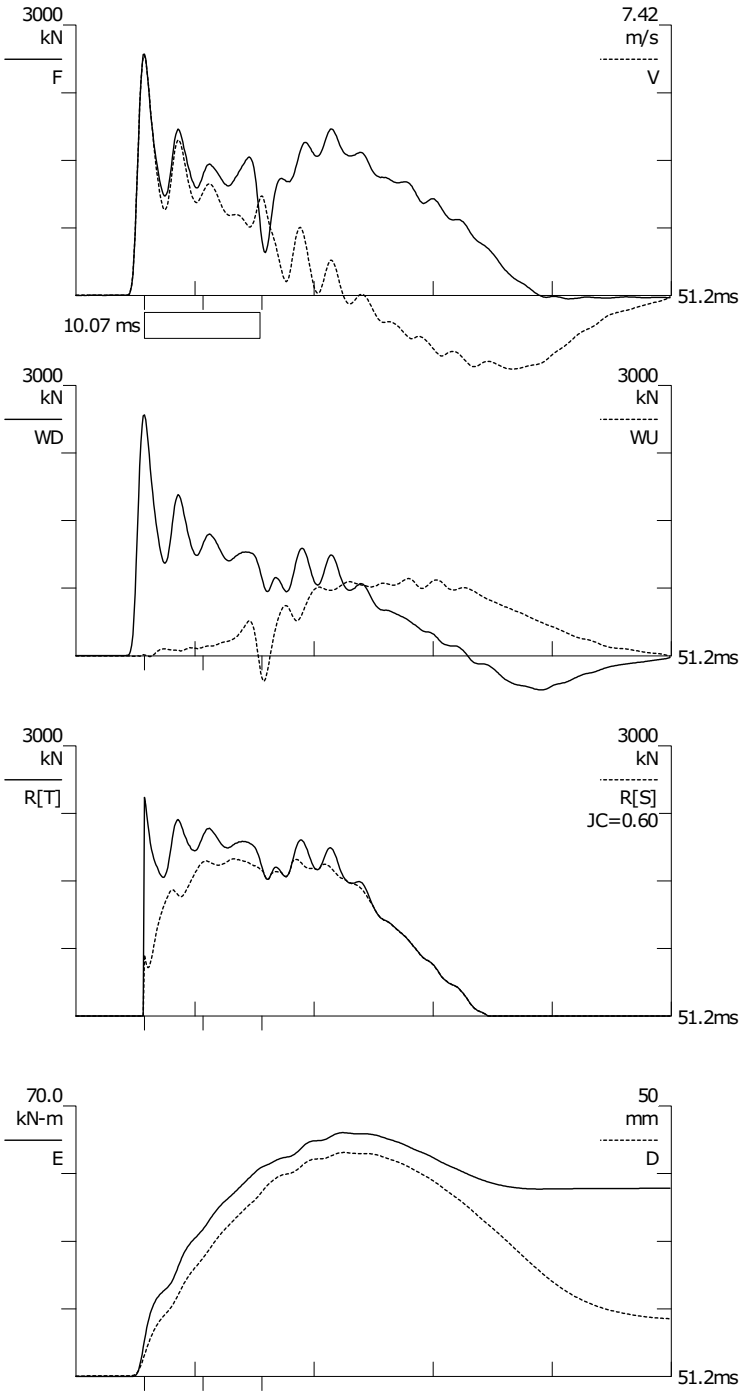
Koepaalutus Tuuliharju
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-T3 24h
Junttan HHK 5A



BN 9
5.3.2015 10:44:51
FMX 2680 kN
RMX 1746 kN
CSX 271.8 MPa
CSI 327.0 MPa
TSX 36.0 MPa
EMX 63.1 kN-m
VMX 6.59 m/s
DMX 41 mm
FVP 1.0 []

LE 25.8 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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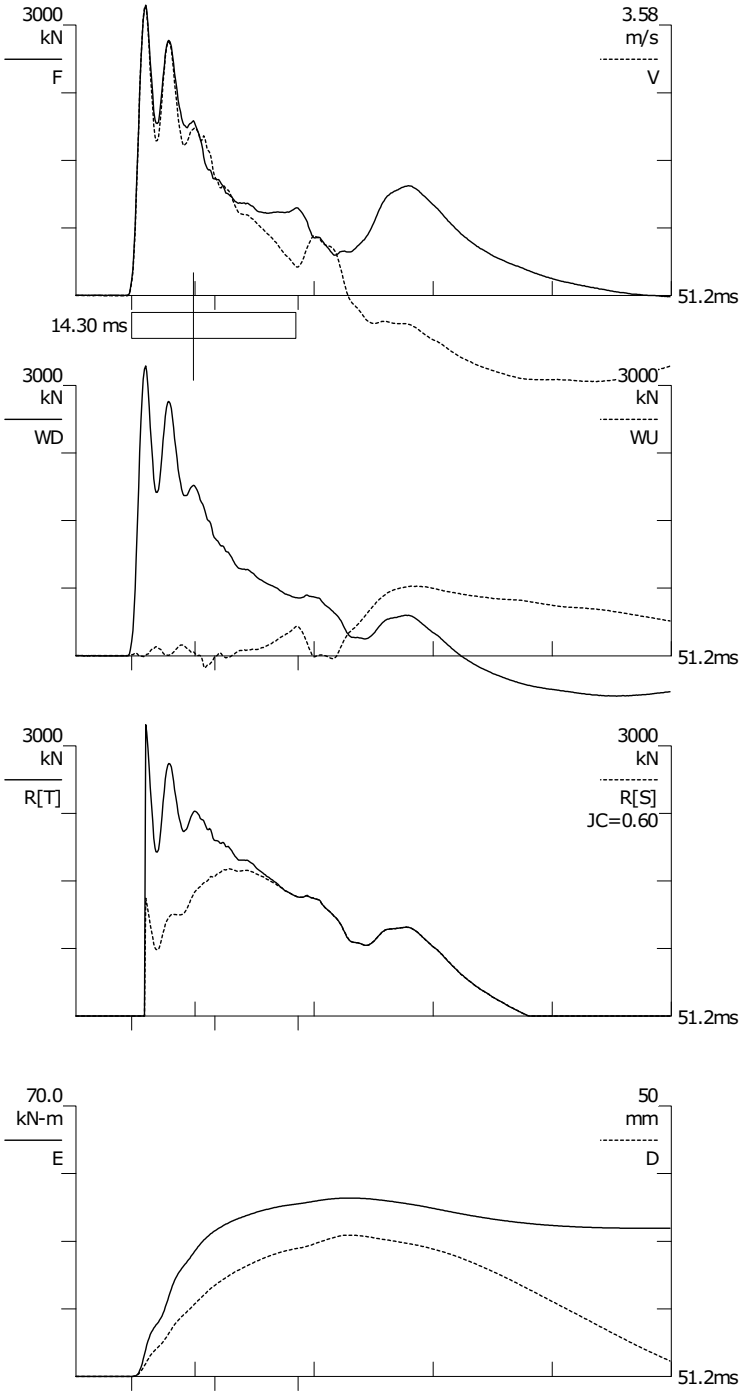
Koepaalutus Tuuliharju
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-B1 24h
Junttan HHK 5A



BN 12
5.3.2015 10:25:40
FMX 3223 kN
RMX 1635 kN
CSX 35.8 MPa
CSI 37.7 MPa
TSX 3.6 MPa
EMX 46.2 kN-m
VMX 3.84 m/s
DMX 26 mm
FVP 1.0 []

LE 25.9 m
AR 900.00 cm^2
EM 33963 MPa
SP 25.0 kN/m3
WS 3650.0 m/s
EA/C 837 kN-s/m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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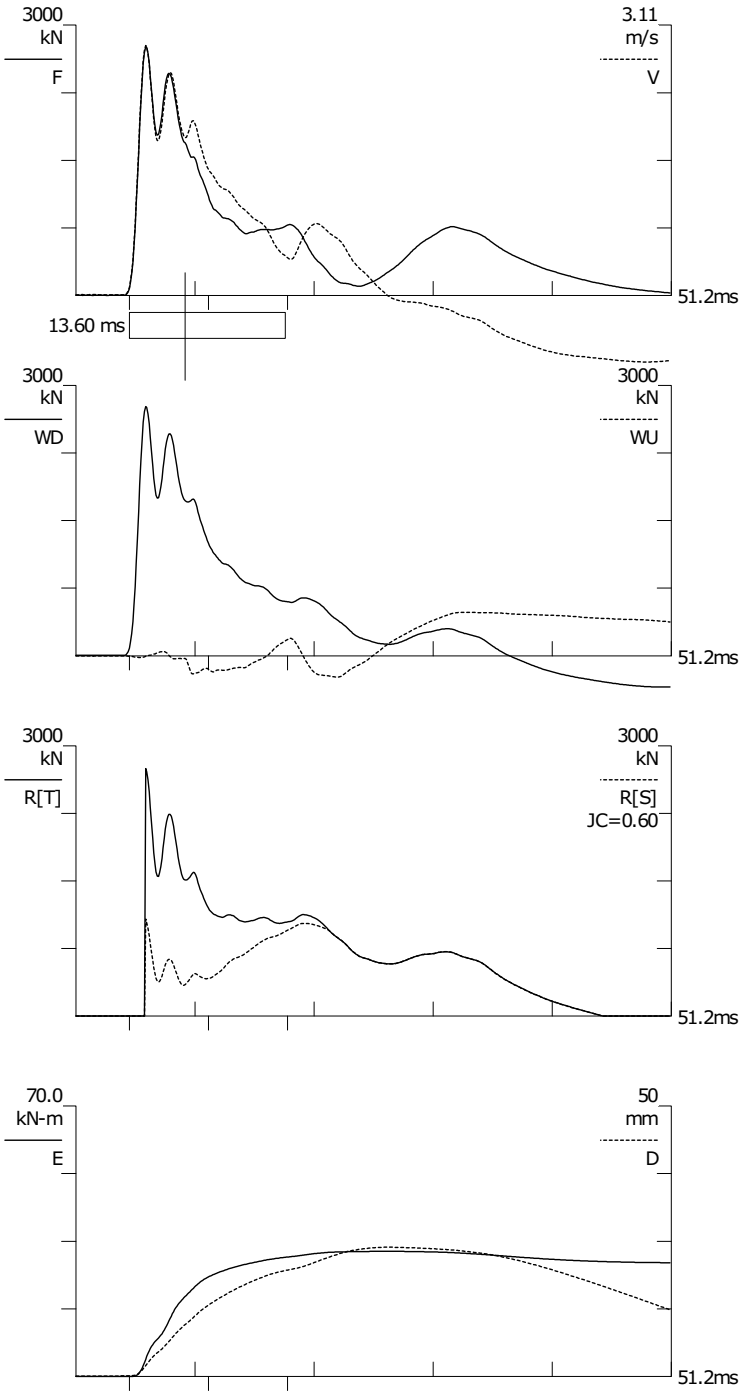
Koepaalutus Tuuliharju
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-B2 24h
Junttan HHK 5A



BN 5
5.3.2015 10:17:22
FMX 2759 kN
RMX 1079 kN
CSX 30.7 MPa
CSI 35.3 MPa
TSX 1.7 MPa
EMX 32.4 kN-m
VMX 2.88 m/s
DMX 24 mm
FVP 1.0 []

LE 24.2 m
AR 900.00 cm^2
EM 44969 MPa
SP 25.0 kN/m3
WS 4200.0 m/s
EA/C 964 kN-s/m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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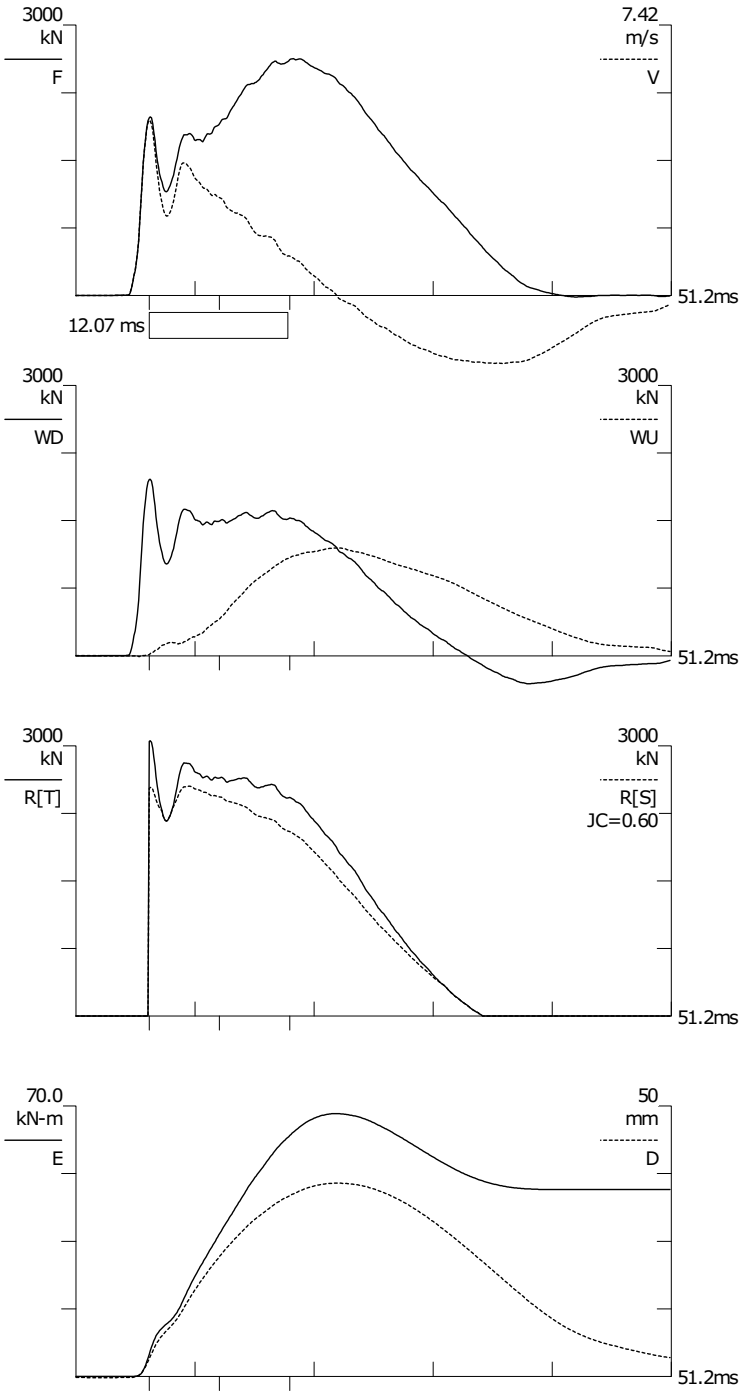
Zatelliitin koepaalutus 14vrk

PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053

ZET1 14 vrk

Junttan HHK 7A



BN 50
18.3.2015 11:54:22
FMX 2627 kN
RMX 2551 kN
CSX 266.4 MPa
CSI 313.1 MPa
TSX 26.5 MPa
EMX 68.1 kN-m
VMX 4.81 m/s
DMX 36 mm
FVP 1.0 []

LE 30.9 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

Tampere University of Technology

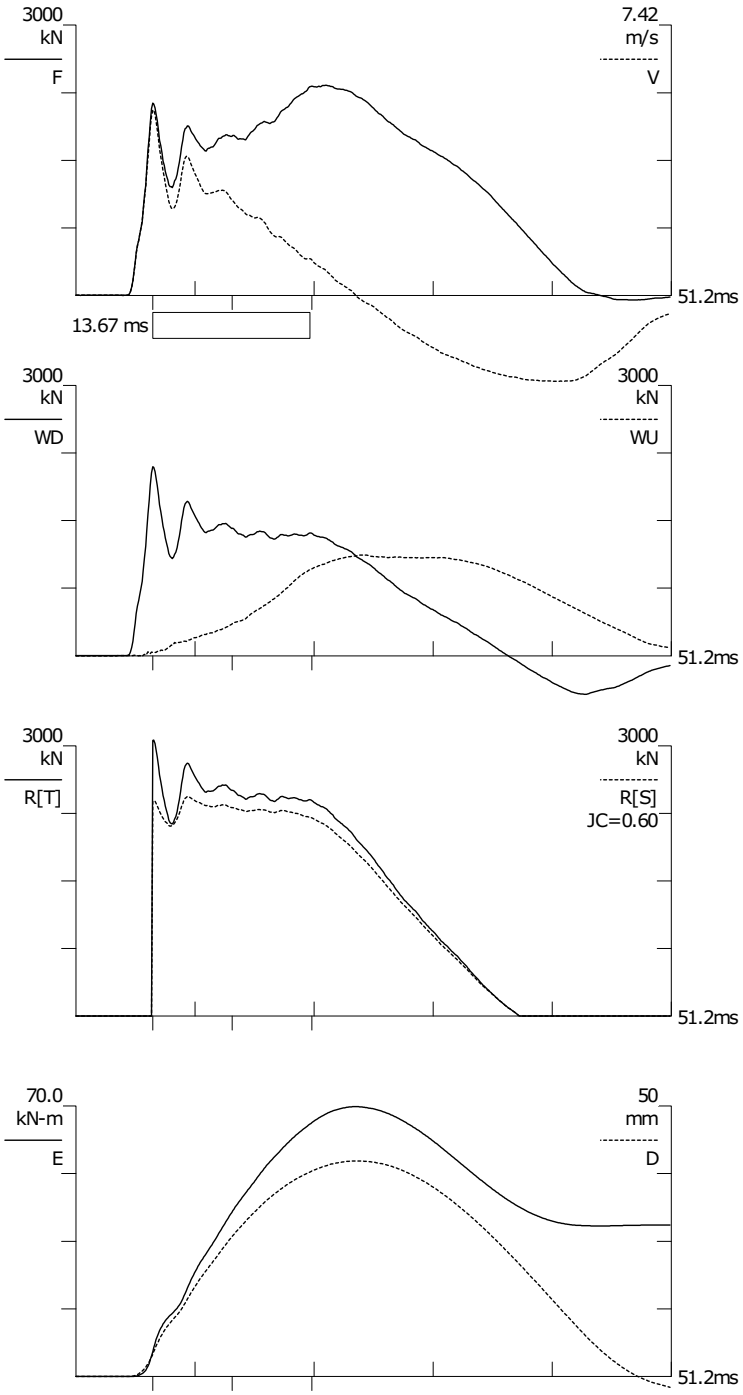
Zatelliitin koepaalutus 14vrk

PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053

ZET2 14 vrk

Junttan HHK 7A



BN 6
18.3.2015 12:15:34
FMX 2335 kN
RMX 2436 kN
CSX 236.8 MPa
CSI 266.4 MPa
TSX 44.8 MPa
EMX 69.9 kN-m
VMX 5.09 m/s
DMX 40 mm
FVP 1.0 []

LE 35.0 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F1234 A12

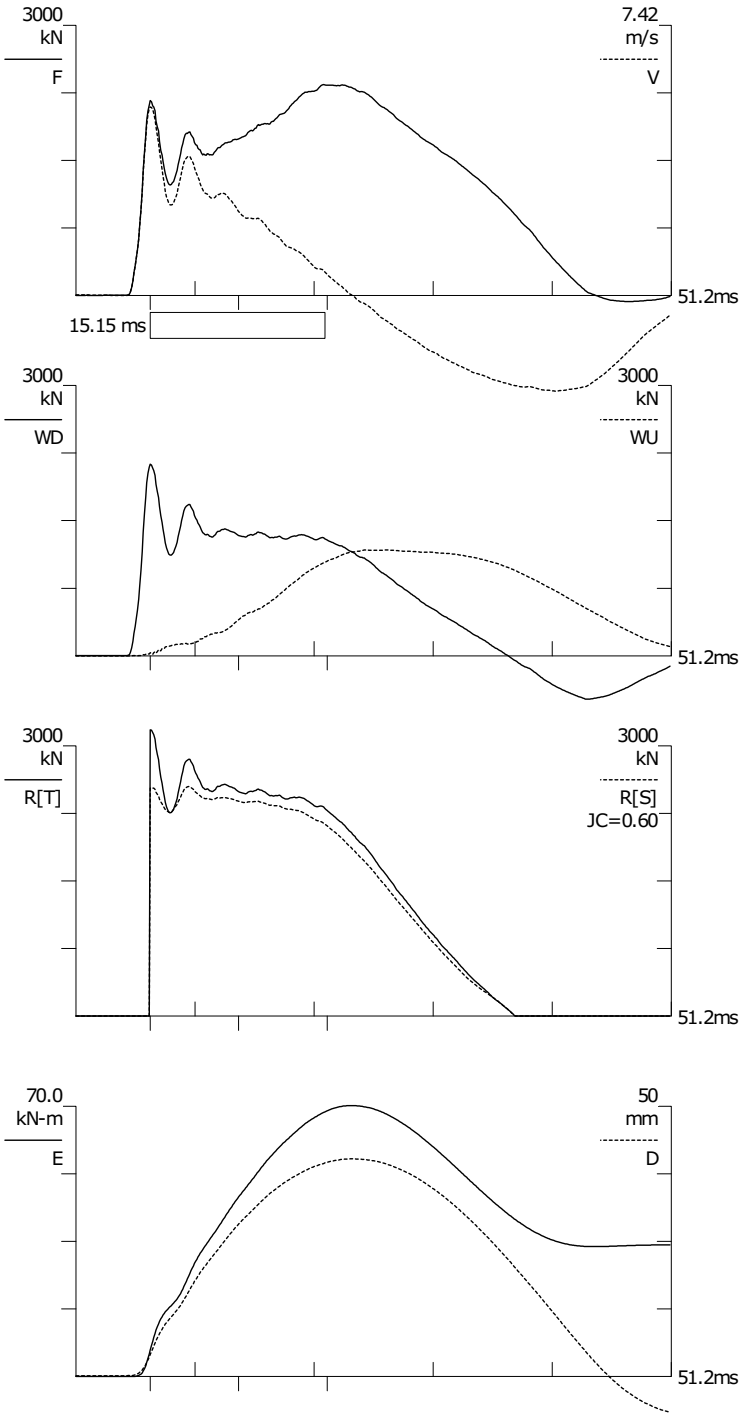
F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

Tampere University of Technology

Zatelliitin koepaalutus 14vrk

PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZET3 14 vrk
Junttan HHK 7A



BN 6
18.3.2015 12:33:34
FMX 2341 kN
RMX 2549 kN
CSX 237.4 MPa
CSI 278.5 MPa
TSX 59.3 MPa
EMX 70.2 kN-m
VMX 5.18 m/s
DMX 40 mm
FVP 1.0 []

LE 38.8 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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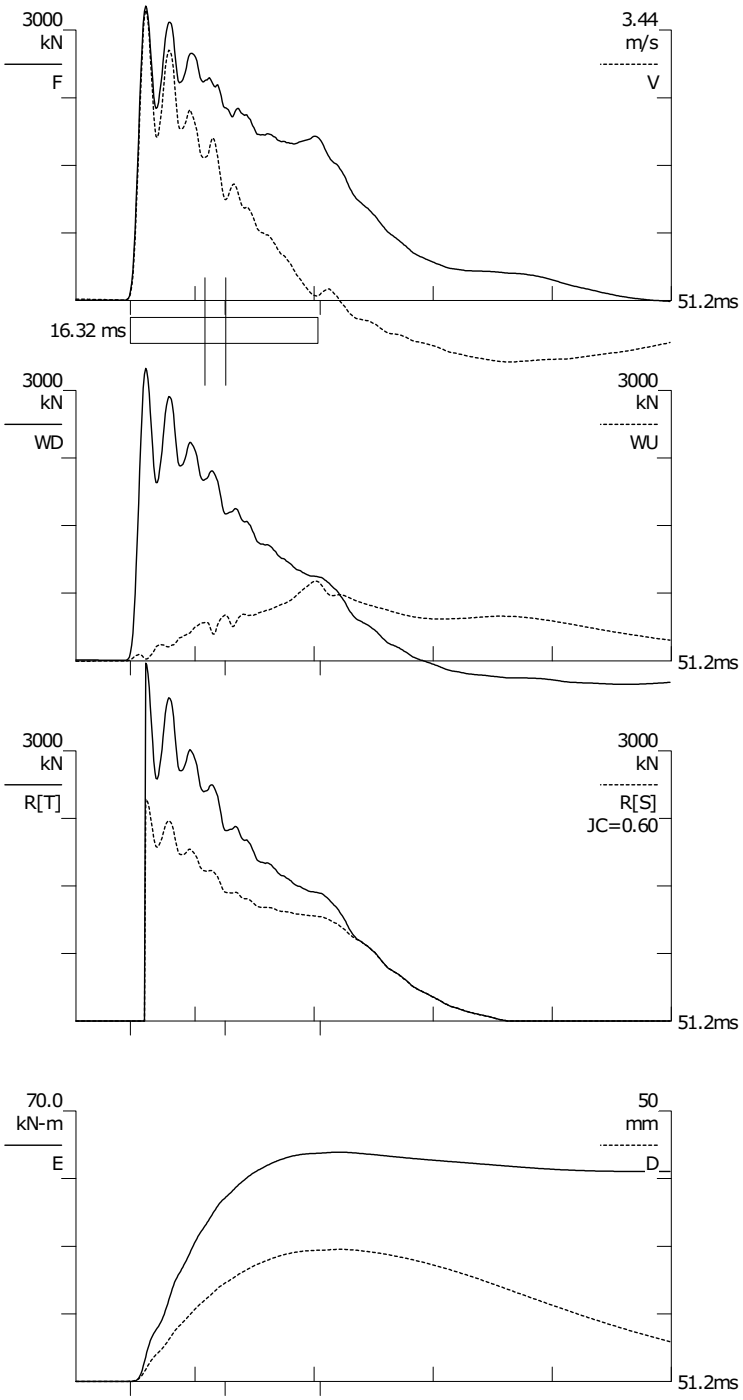
Zatelliitin koepaalutus 14vrk
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZEB1 14 vrk
Junttan HHK 7A



BN 8
18.3.2015 8:27:51
FMX 3267 kN
RMX 2463 kN
CSX 36.3 MPa
CSI 44.1 MPa
TSX 2.3 MPa
EMX 59.4 kN-m
VMX 3.70 m/s
DMX 24 mm
FVP 1.0 []

LE 31.0 m
AR 900.00 cm^2
EM 36812 MPa
SP 25.0 kN/m3
WS 3800.0 m/s
EA/C 872 kN-s/m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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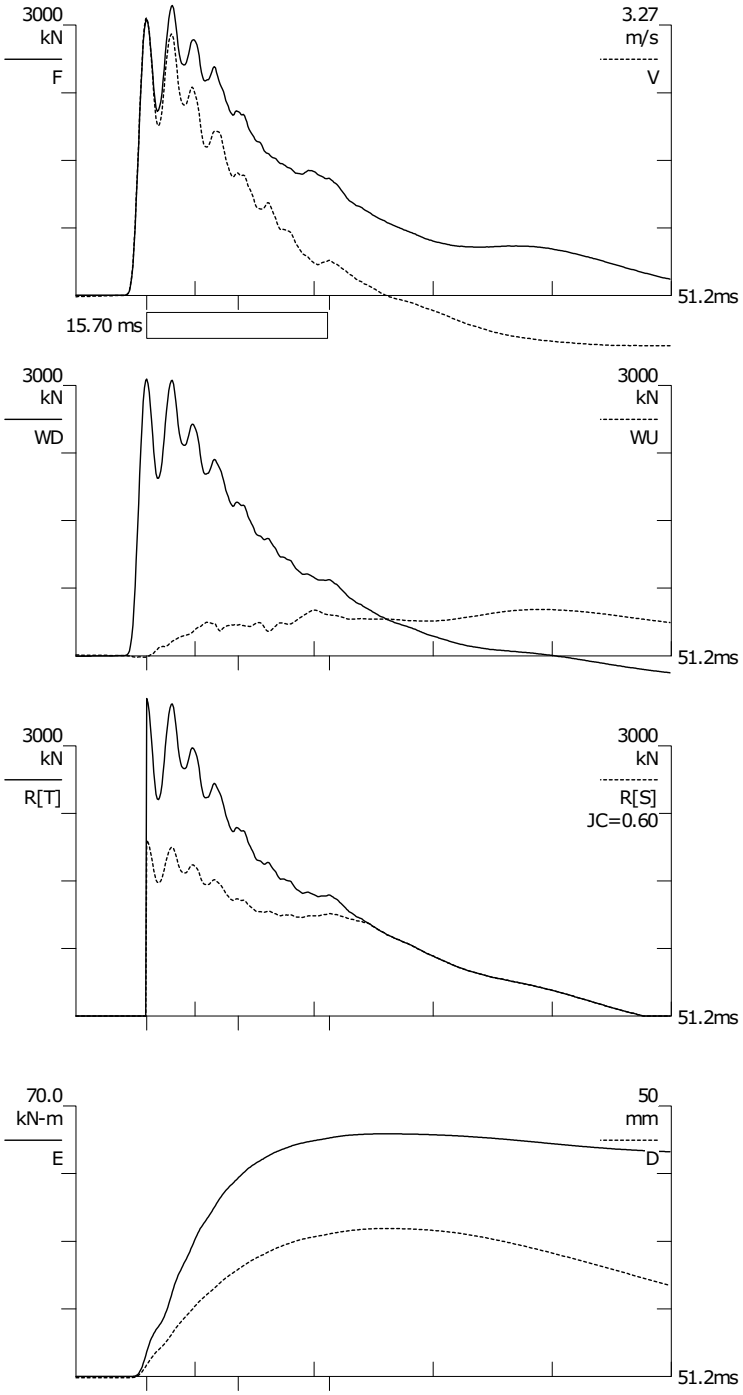
Zatelliitin koepaalutus 14vrk

PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053

ZEB2 14 vrk

Junttan HHK 7A



BN 8
18.3.2015 8:12:35
FMX 3217 kN
RMX 1954 kN
CSX 35.7 MPa
CSI 47.1 MPa
TSX 1.4 MPa
EMX 62.8 kN-m
VMX 3.36 m/s
DMX 27 mm
FVP 1.0 []

LE 27.5 m
AR 900.00 cm^2
EM 40789 MPa
SP 25.0 kN/m3
WS 4000.0 m/s
EA/C 918 kN-s/m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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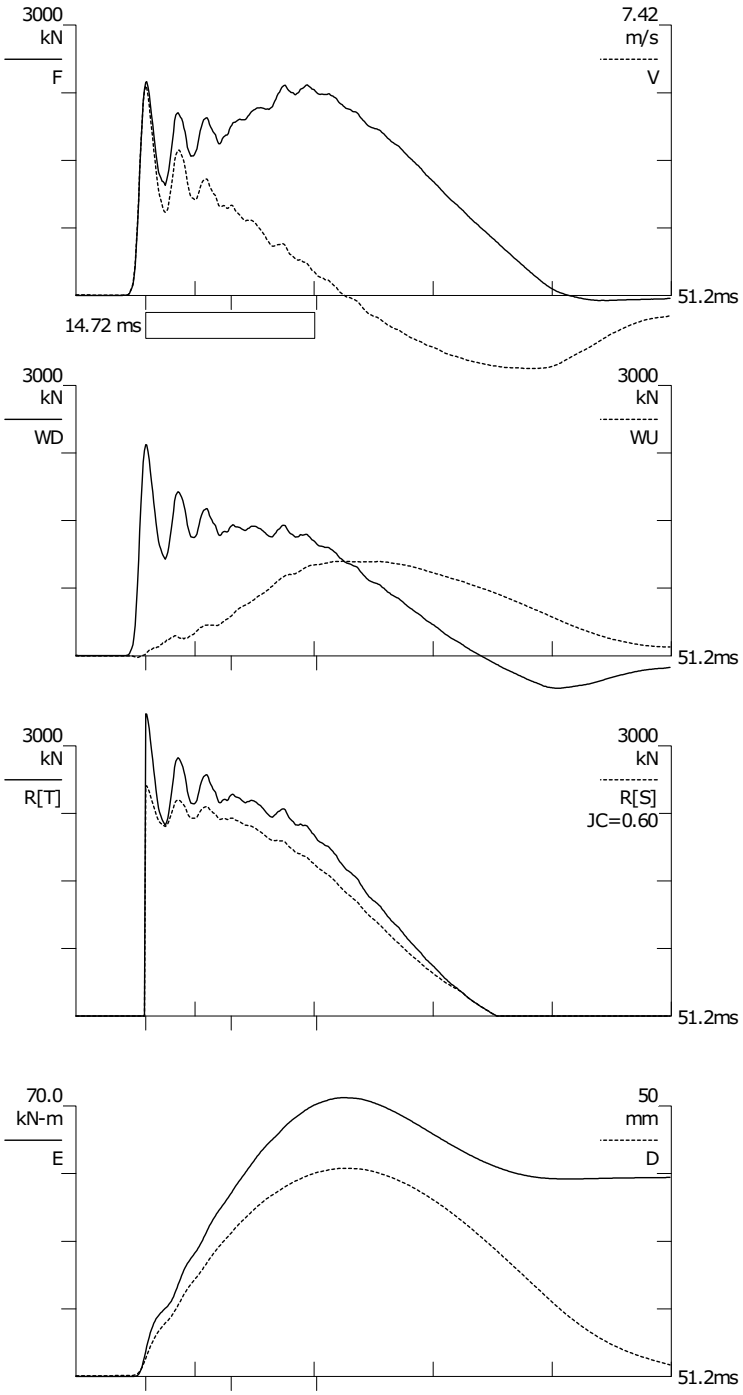
Zatelliitin koepaalutus 14vrk

PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053

ZPT4 14 vrk

Junttan HHK 7A



BN 14
18.3.2015 10:37:18
FMX 2375 kN
RMX 2555 kN
CSX 240.8 MPa
CSI 283.2 MPa
TSX 35.2 MPa
EMX 72.2 kN-m
VMX 5.75 m/s
DMX 38 mm
FVP 1.0 []

LE 37.7 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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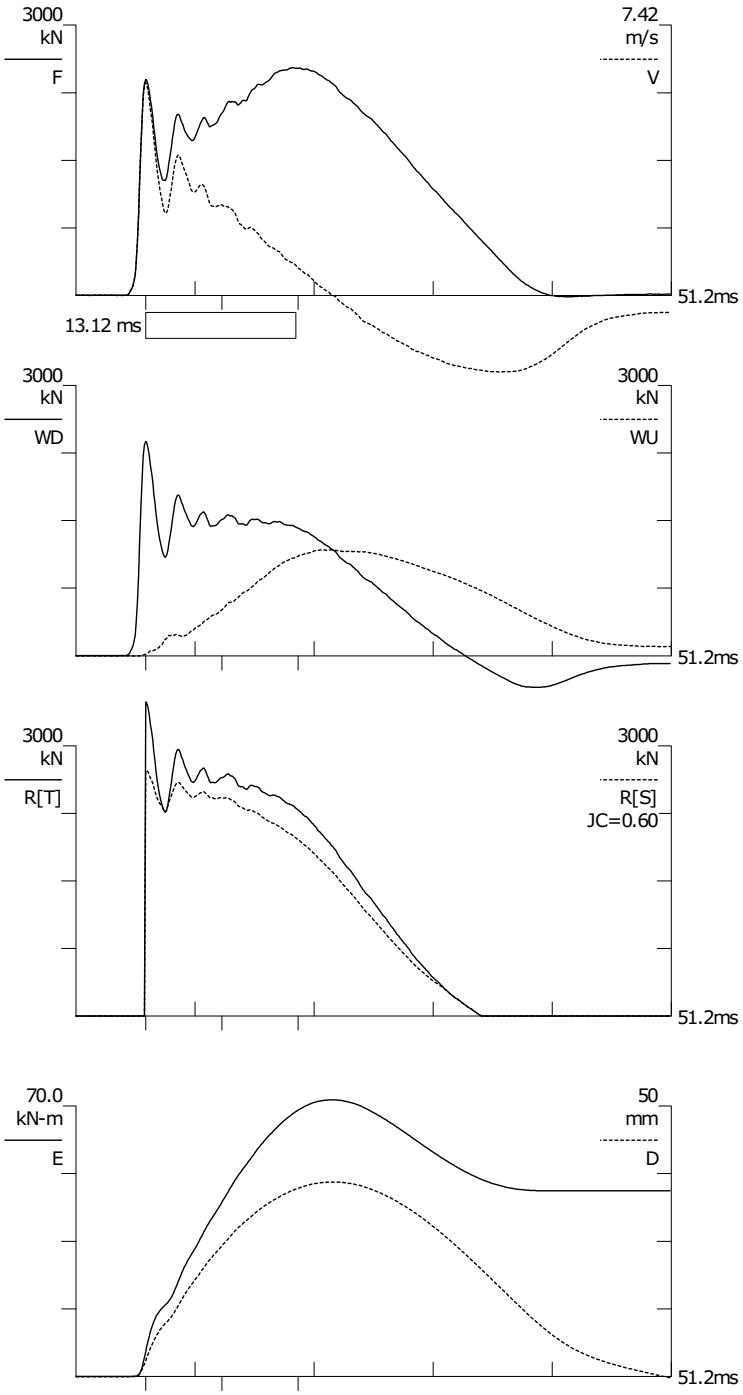
Zatelliitin koepaalutus 14vrk

PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053

ZPT5 14 vrk

Junttan HHK 7A



BN 10
18.3.2015 10:08:59
FMX 2530 kN
RMX 2726 kN
CSX 256.5 MPa
CSI 287.5 MPa
TSX 25.8 MPa
EMX 71.6 kN-m
VMX 5.85 m/s
DMX 36 mm
FVP 1.0 []

LE 33.6 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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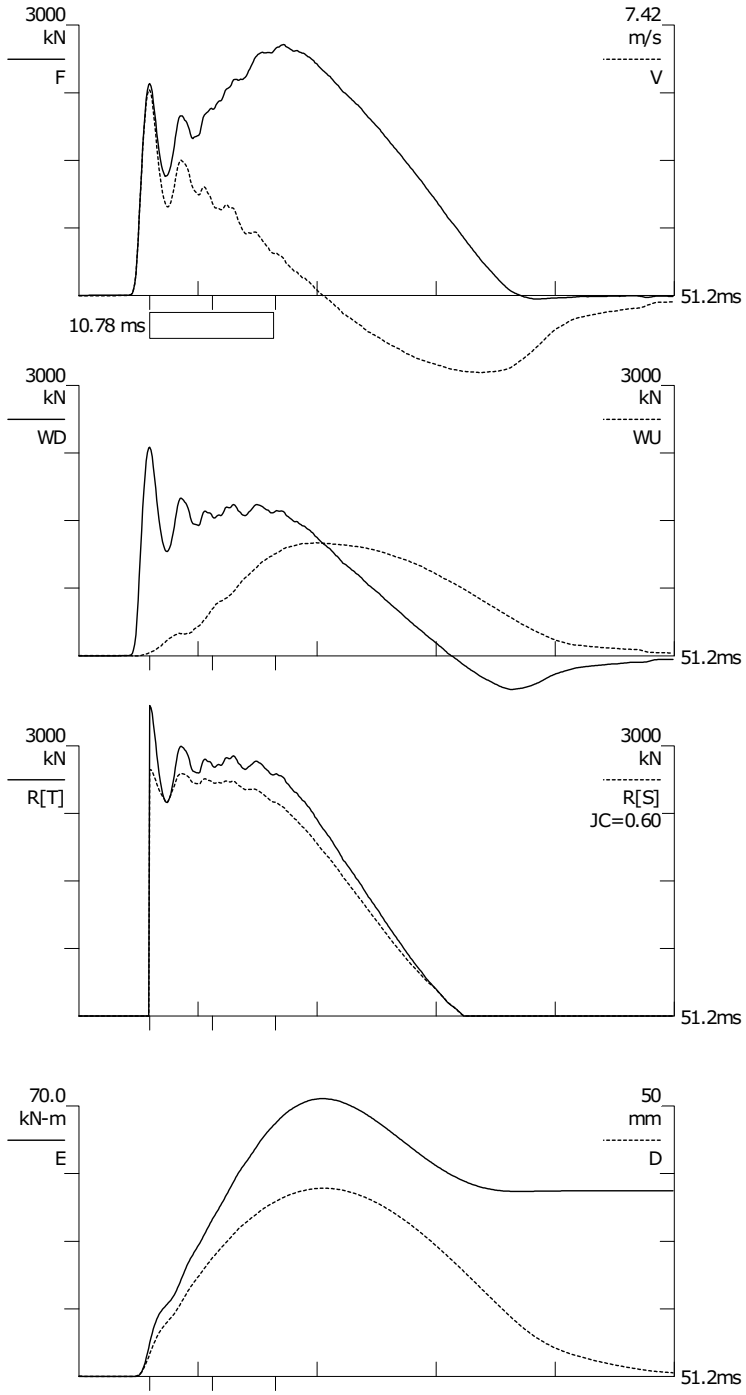
Zatelliitin koepaalutus 14vrk
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZPT6 14 vrk
Junttan HHK 7A



BN 17
18.3.2015 9:51:00
FMX 2786 kN
RMX 2738 kN
CSX 282.5 MPa
CSI 350.2 MPa
TSX 31.1 MPa
EMX 71.9 kN-m
VMX 5.64 m/s
DMX 35 mm
FVP 1.0 []

LE 27.6 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

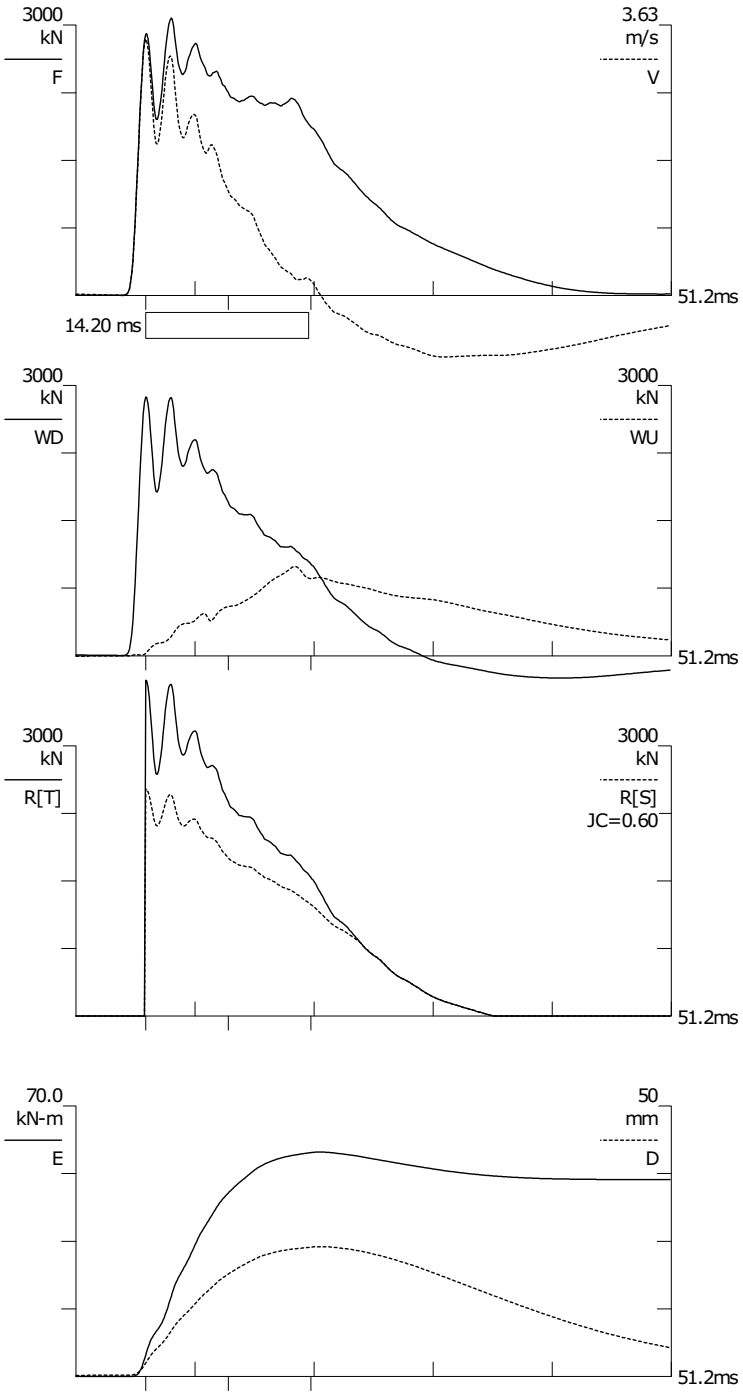
F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

Tampere University of Technology

Zatelliitin koepaalutus 14vrk
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZPB3 14 vrk
Junttan HHK 7A



BN 12
18.3.2015 9:02:15
FMX 3080 kN
RMX 2518 kN
CSX 34.2 MPa
CSI 38.8 MPa
TSX 1.2 MPa
EMX 58.1 kN-m
VMX 3.44 m/s
DMX 24 mm
FVP 1.0 []

LE 27.5 m
AR 900.00 cm^2
EM 33039 MPa
SP 25.0 kN/m3
WS 3600.0 m/s
EA/C 826 kN-s/m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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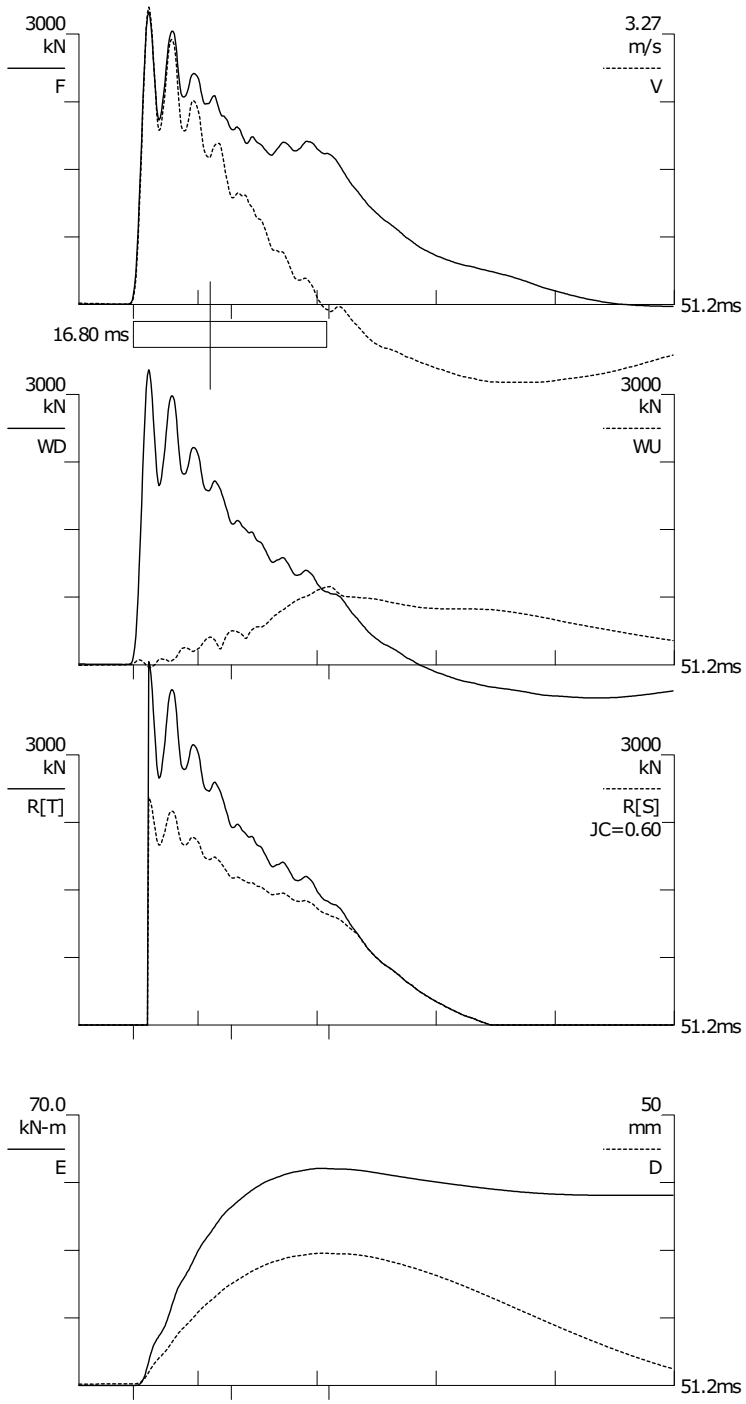
Zatelliitin koepaalutus 14vrk
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZPB4 14 vrk
Junttan HHK 7A



BN 6
18.3.2015 8:46:29
FMX 3249 kN
RMX 2526 kN
CSX 36.1 MPa
CSI 40.1 MPa
TSX 2.4 MPa
EMX 56.2 kN-m
VMX 3.59 m/s
DMX 24 mm
FVP 1.0 []

LE 32.7 m
AR 900.00 cm^2
EM 40789 MPa
SP 25.0 kN/m3
WS 4000.0 m/s
EA/C 918 kN-s/m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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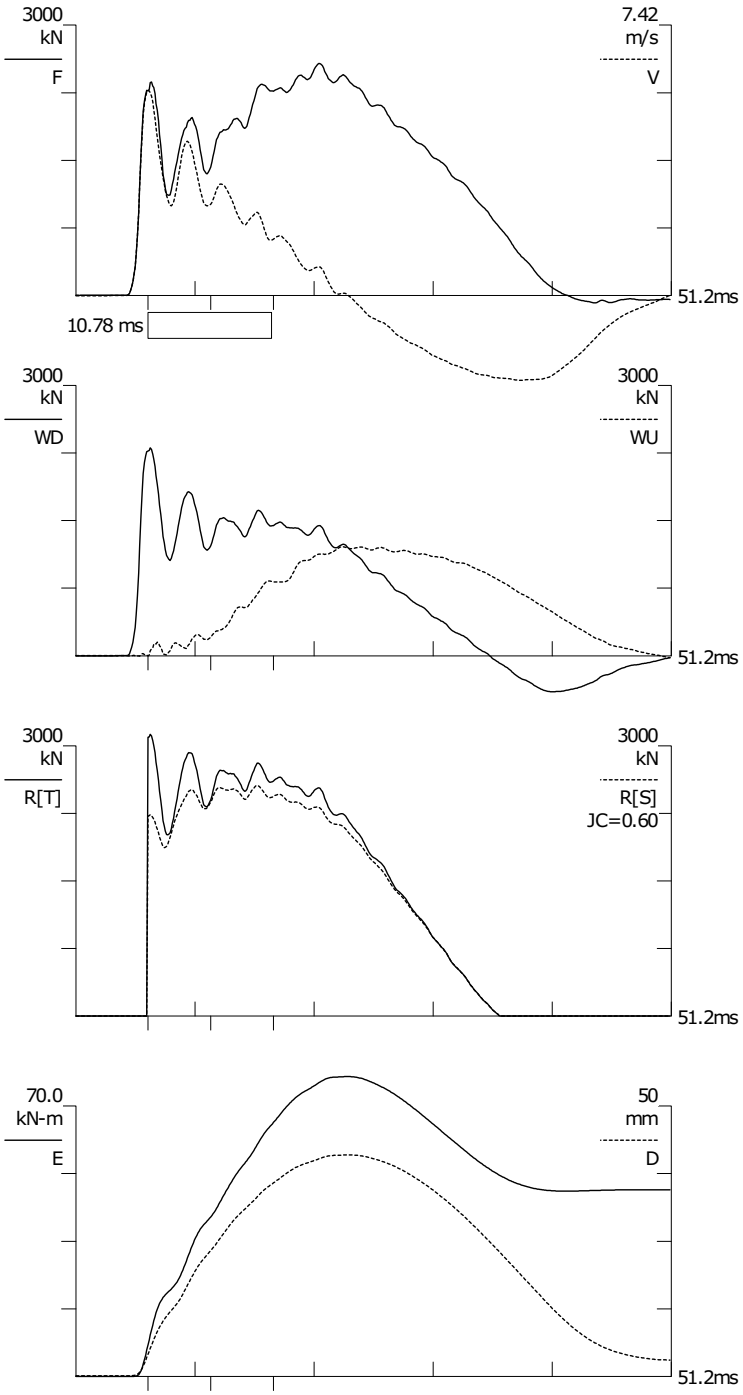
Tuuliharjun koepaalutus 14vrk
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-T1 14 vrk
Junttan HHK 7A



BN 9
18.3.2015 14:33:28
FMX 2576 kN
RMX 2560 kN
CSX 261.2 MPa
CSI 314.9 MPa
TSX 45.5 MPa
EMX 77.6 kN-m
VMX 5.63 m/s
DMX 41 mm
FVP 1.0 []

LE 27.6 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

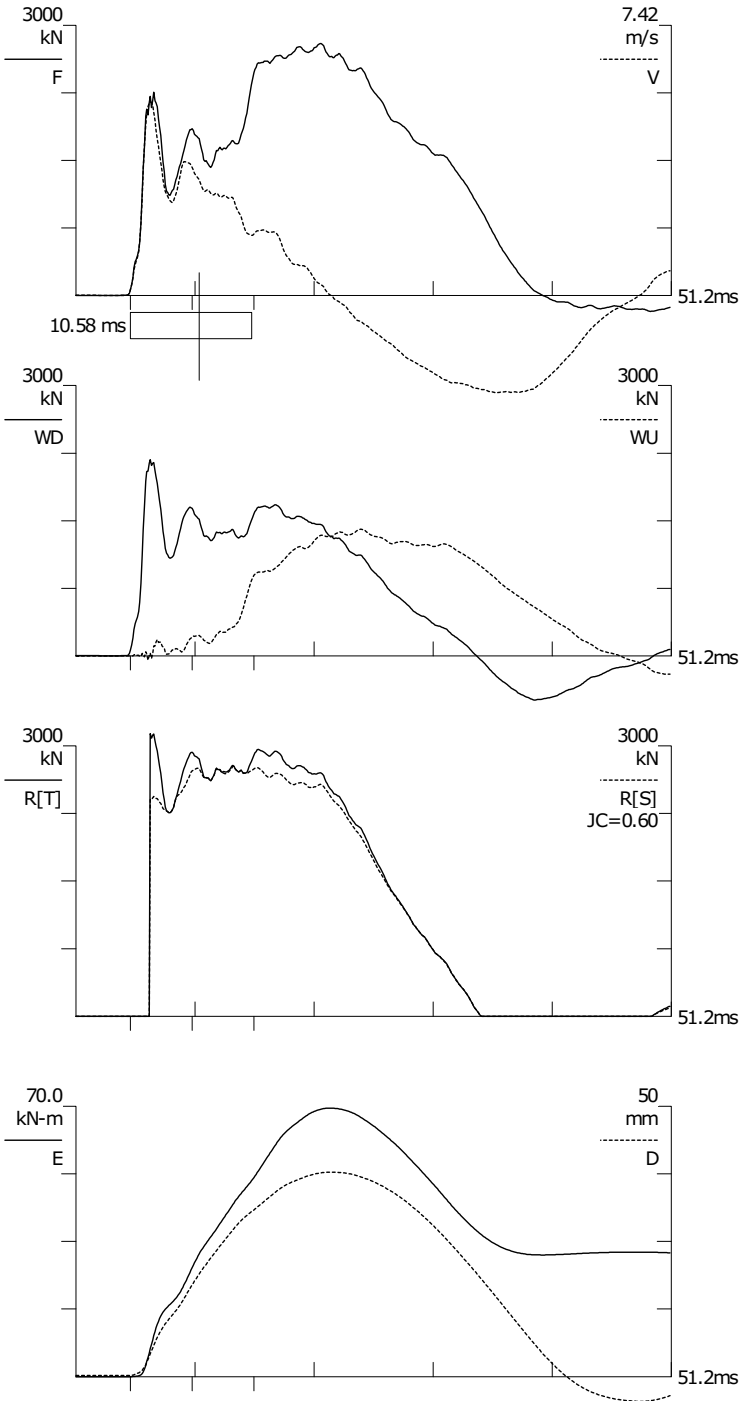
F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

Tampere University of Technology

Tuuliharjun koepaalutus 14vrk
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-T2 14 vrk
Junttan HHK 7A



BN 10
18.3.2015 14:44:38
FMX 2796 kN
RMX 2774 kN
CSX 283.5 MPa
CSI 339.9 MPa
TSX 68.7 MPa
EMX 69.5 kN-m
VMX 5.31 m/s
DMX 38 mm
FVP 1.0 []

LE 27.1 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

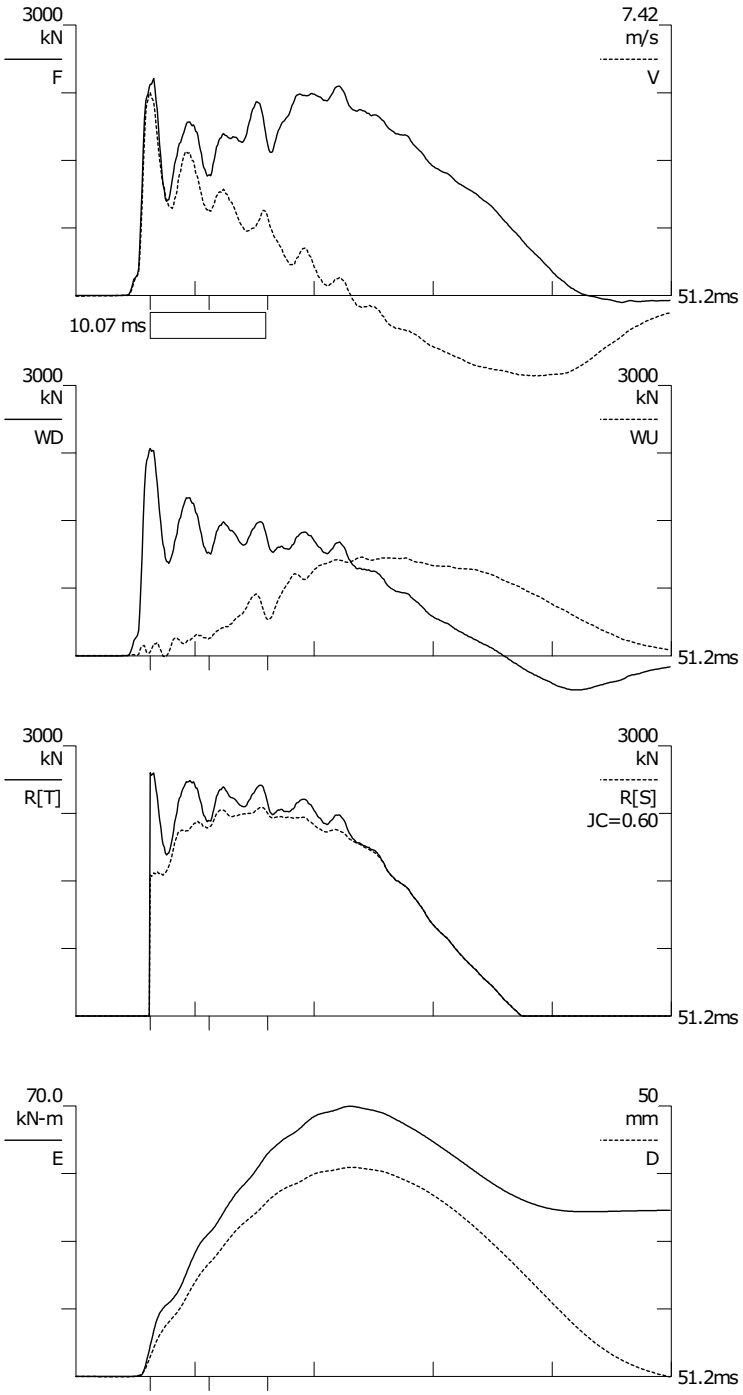
F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

Tampere University of Technology

Tuuliharjun koepaalutus 14vrk
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-T3 14 vrk
Junttan HHK 7A



BN 8
18.3.2015 14:56:31
FMX 2407 kN
RMX 2314 kN
CSX 244.1 MPa
CSI 296.1 MPa
TSX 36.7 MPa
EMX 69.9 kN-m
VMX 5.57 m/s
DMX 39 mm
FVP 1.0 []

LE 25.8 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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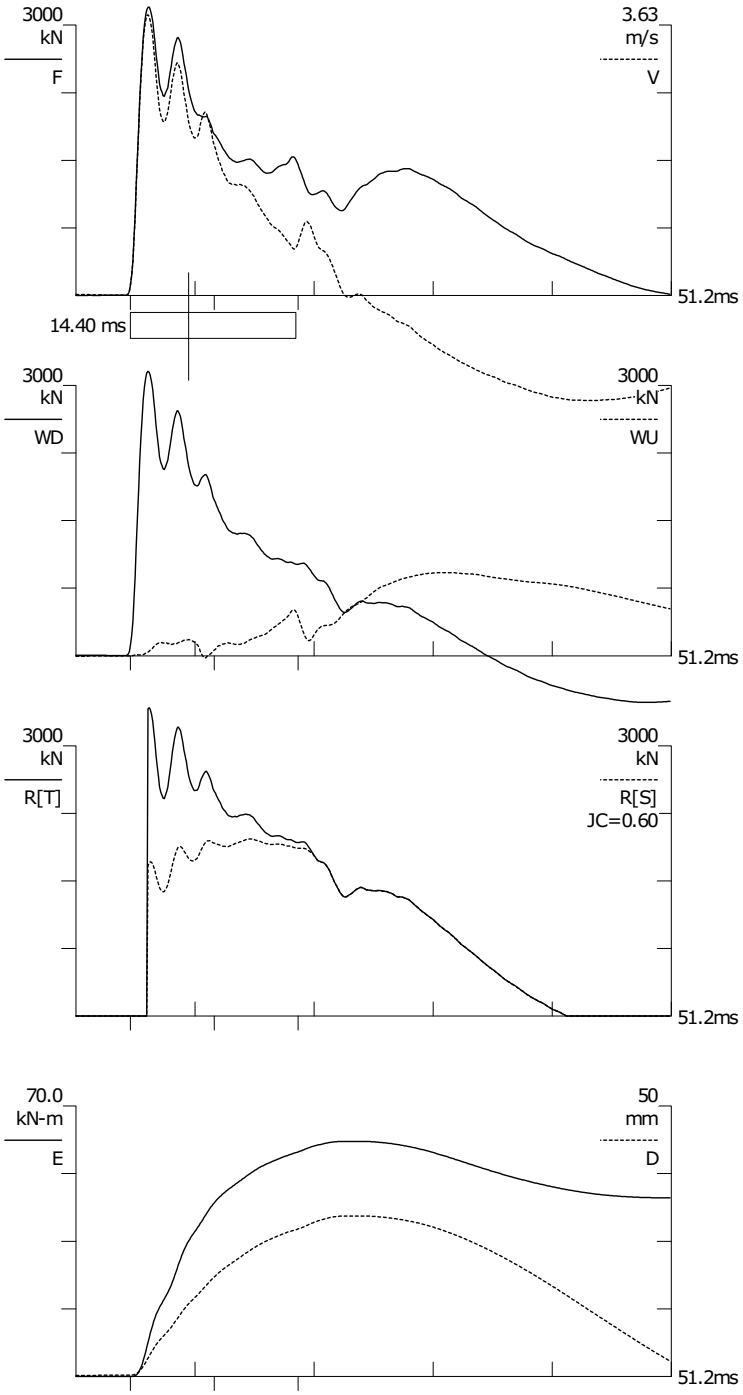
Tuuliharjun koepaalutus 14vrk
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-B1 14 vrk
Junttan HHK 7A



BN 7
18.3.2015 15:11:09
FMX 3201 kN
RMX 1966 kN
CSX 35.6 MPa
CSI 38.7 MPa
TSX 3.1 MPa
EMX 60.8 kN-m
VMX 3.77 m/s
DMX 30 mm
FVP 1.0 []

LE 25.9 m
AR 900.00 cm^2
EM 33039 MPa
SP 25.0 kN/m3
WS 3600.0 m/s
EA/C 826 kN-s/m

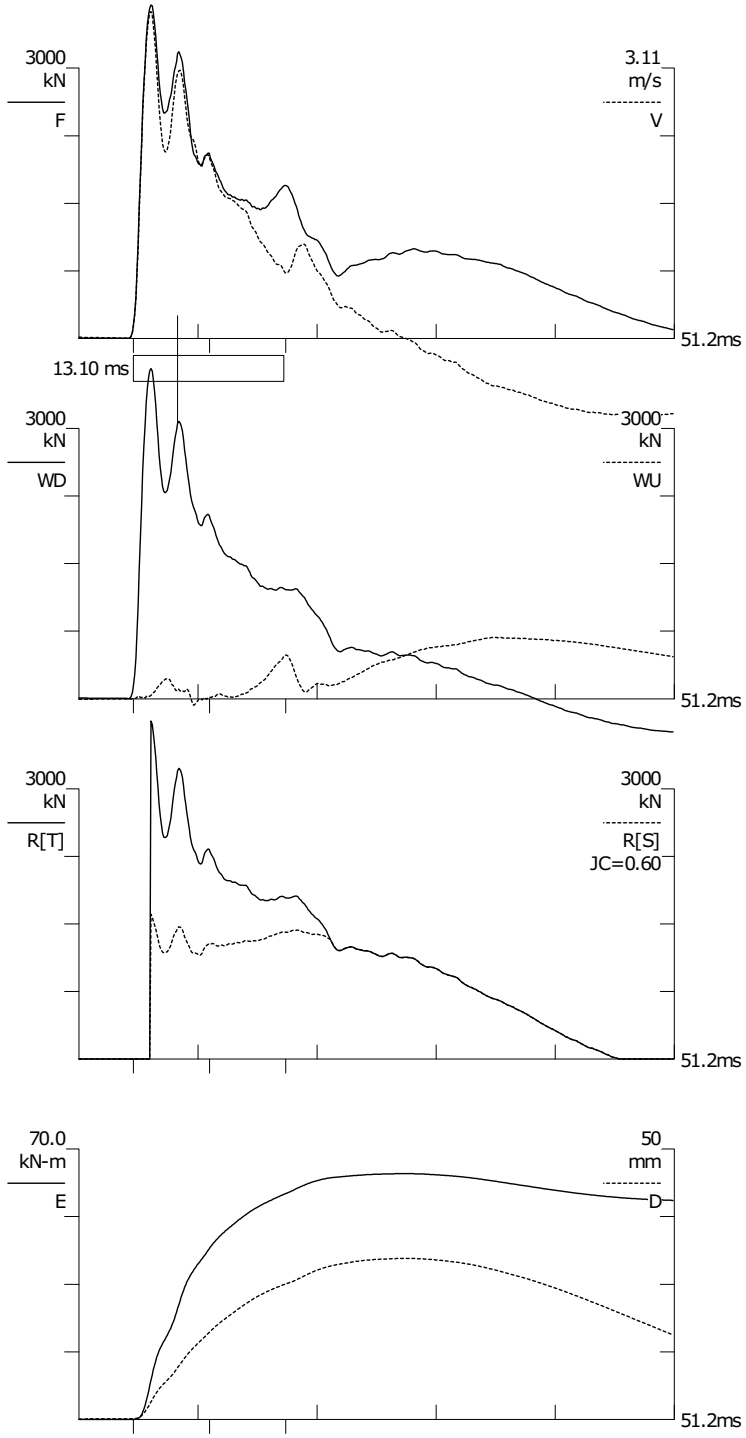
F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

Tampere University of Technology

Tuuliharjun koepaalutus 14vrk
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-B2 14 vrk
Junttan HHK 7A



BN 5
18.3.2015 15:19:08
FMX 3702 kN
RMX 1605 kN
CSX 41.1 MPa
CSI 42.4 MPa
TSX 2.1 MPa
EMX 63.6 kN-m
VMX 3.77 m/s
DMX 30 mm
FVP 1.0 []

LE 24.2 m
AR 900.00 cm^2
EM 44969 MPa
SP 25.0 kN/m3
WS 4200.0 m/s
EA/C 964 kN-s/m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

Tampere University of Technology

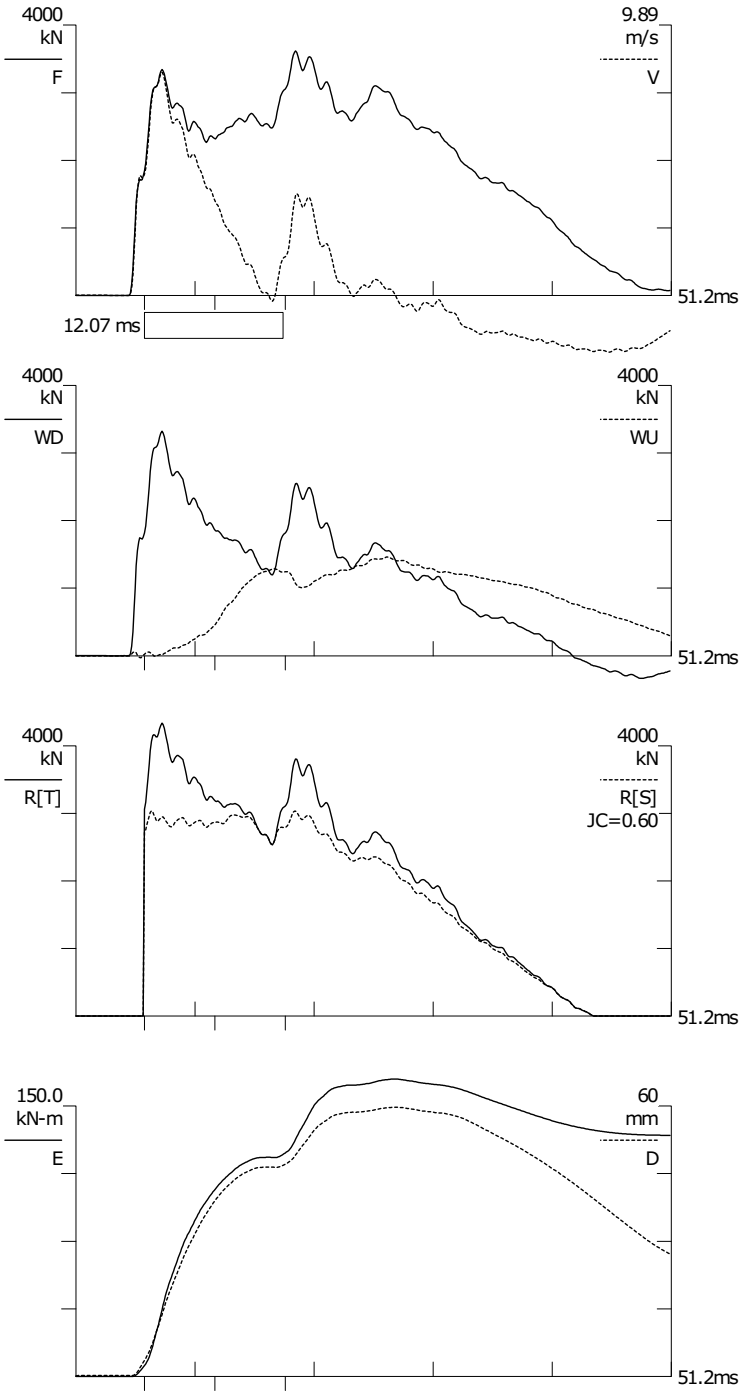
Zatelliitin koepaalutus

PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053

ZET1 28vrk

Vapaapudotusjarkale 9t



BN 25
31.3.2015 15:15:22
FMX 3618 kN
RMX 3036 kN
CSX 366.9 MPa
CSI 381.2 MPa
TSX 19.5 MPa
EMX 165.0 kN-m
VMX 8.17 m/s
DMX 60 mm
FVP 1.0 []

LE 30.9 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F12 A12

F1: [J246] 91.4 (1)
F2: [J439] 92.1 (1)
A1: [45903] 1165 g's/v (1)
A2: [45906] 1130 g's/v (1)

Tampere University of Technology

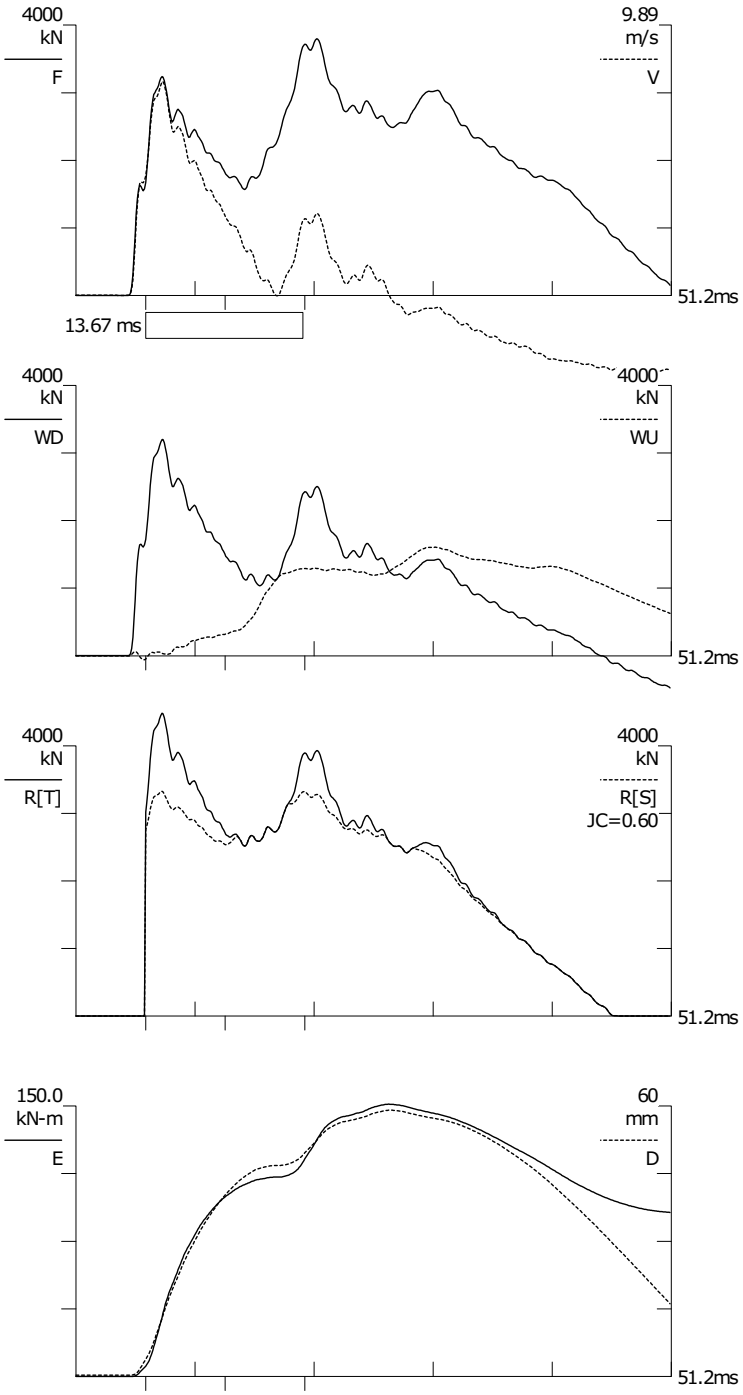
Zatelliitin koepaalutus

PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053

ZET2 28vrk

Vapaapudotusjarkale 9t



BN 27
31.3.2015 16:31:11
FMX 3798 kN
RMX 3327 kN
CSX 385.1 MPa
CSI 427.2 MPa
TSX 45.0 MPa
EMX 151.0 kN-m
VMX 7.83 m/s
DMX 59 mm
FVP 0.9 []

LE 35.0 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F12 A12

F1: [J246] 91.4 (1)
F2: [J439] 92.1 (1)
A1: [45903] 1165 g's/v (1)
A2: [45906] 1130 g's/v (1)

Tampere University of Technology

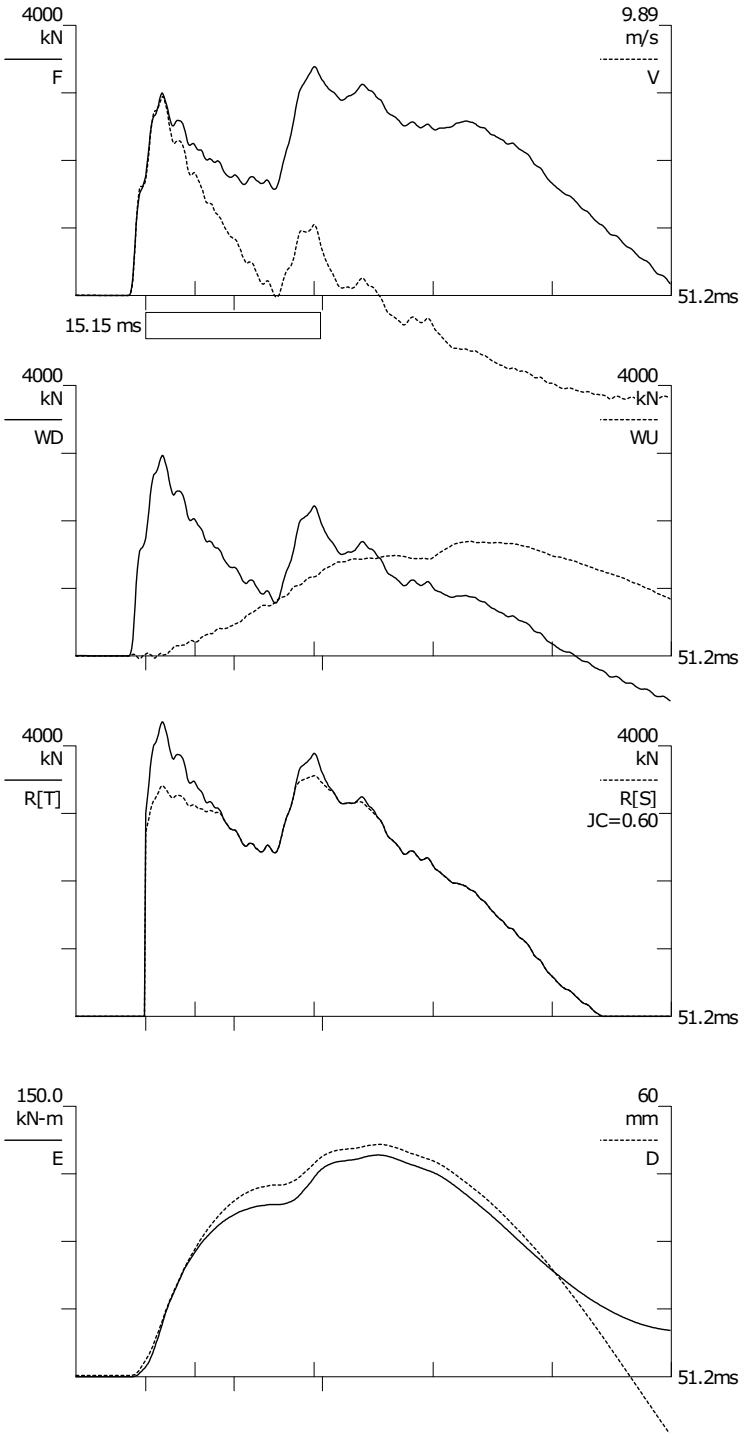
Zatelliitin koepaalutus

PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053

ZET3 28vrk

Vapaapudotusjarkale 9t



BN 23
31.3.2015 17:09:29
FMX 3389 kN
RMX 3561 kN
CSX 343.7 MPa
CSI 399.9 MPa
TSX 67.3 MPa
EMX 122.9 kN-m
VMX 7.29 m/s
DMX 52 mm
FVP 1.0 []

LE 38.8 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F12 A1

F1: [9129] 92.9 (1)
F2: [8603] 93.3 (1)
A1: [16191] 1040 g's/v (1)

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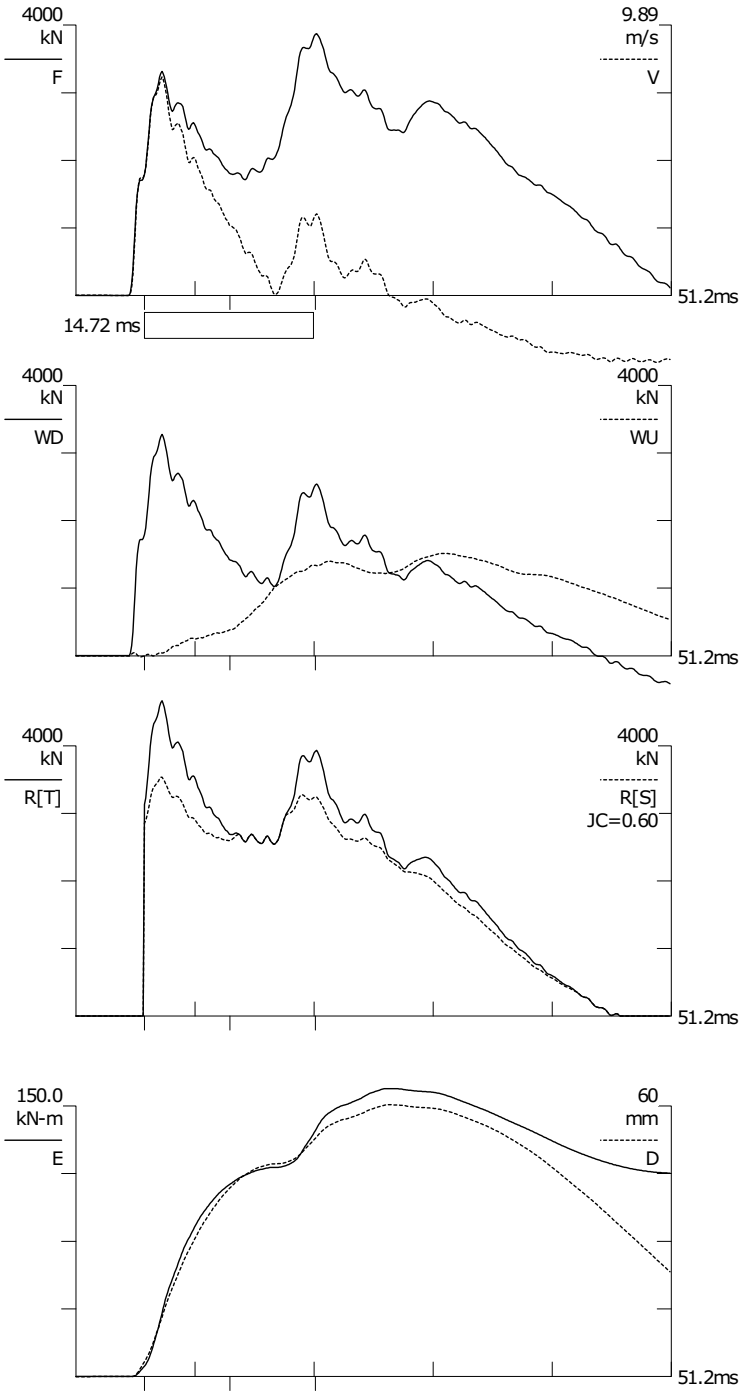
Zatelliitin koepaalutus

PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053

ZPT4 28vrk

Vapaapudotusjarkale 9t



BN 37
31.3.2015 14:45:25
FMX 3875 kN
RMX 3533 kN
CSX 392.9 MPa
CSI 429.3 MPa
TSX 40.8 MPa
EMX 159.7 kN-m
VMX 8.00 m/s
DMX 60 mm
FVP 1.0 []

LE 37.7 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F12 A12

F1: [J246] 91.4 (1)
F2: [J439] 92.1 (1)
A1: [45903] 1165 g's/v (1)
A2: [45906] 1130 g's/v (1)

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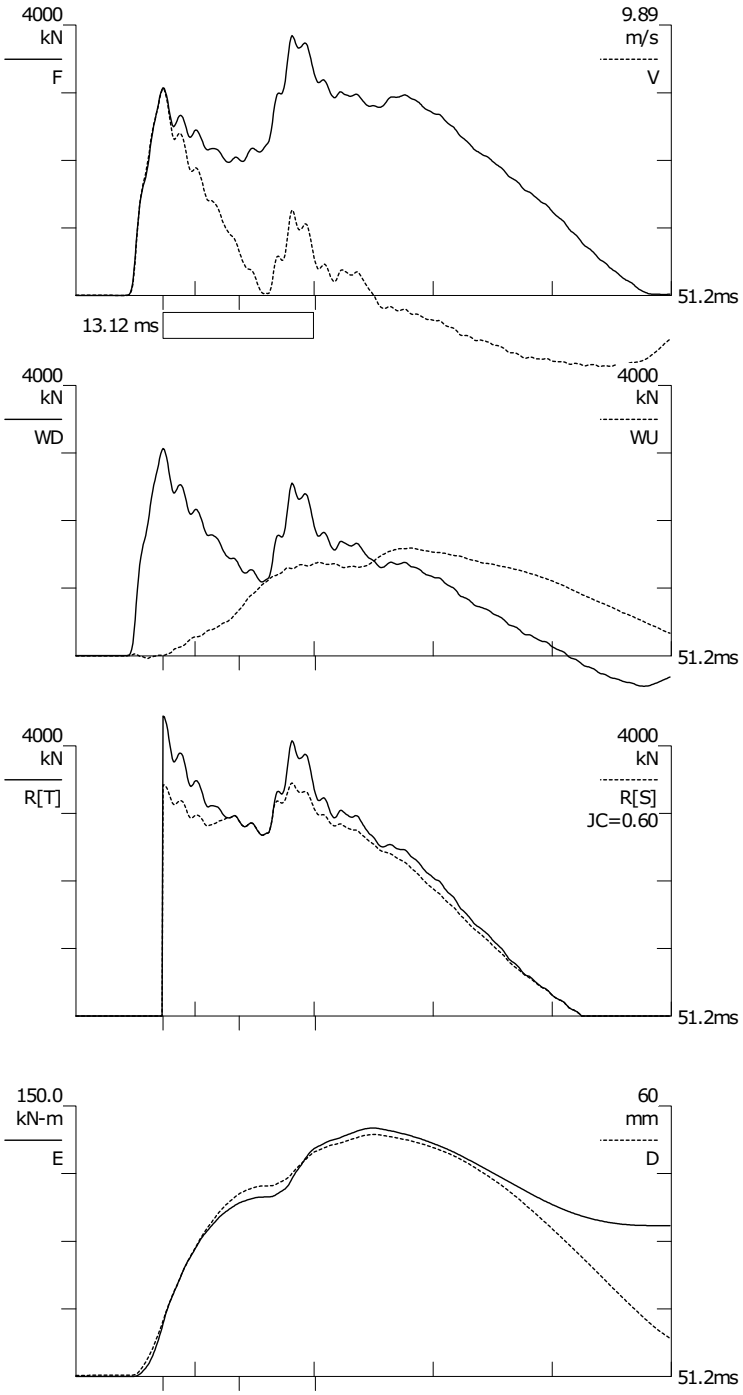
Zatelliitin koepaalutus
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZPT5 28vrk
Vapaapudotusjarkale 9t



BN 8
31.3.2015 14:16:54
FMX 3845 kN
RMX 3450 kN
CSX 389.9 MPa
CSI 415.2 MPa
TSX 36.3 MPa
EMX 137.8 kN-m
VMX 7.58 m/s
DMX 54 mm
FVP 1.0 []

LE 33.6 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F12 A12

F1: [J246] 91.4 (1)
F2: [J439] 92.1 (1)
A1: [45903] 1165 g's/v (1)
A2: [45906] 1130 g's/v (1)

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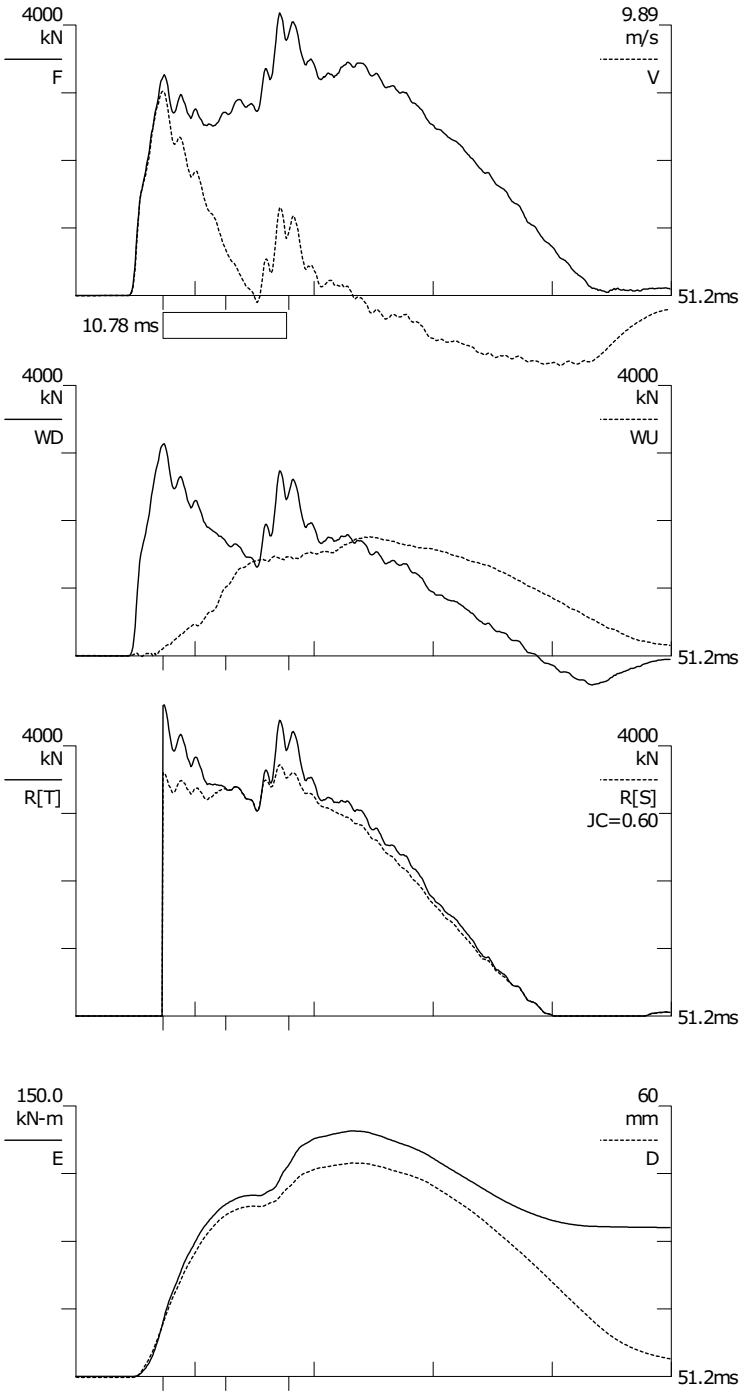
Zatelliitin koepaalutus

PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053

ZPT6 28vrk

Vapaapudotusjarkale 9t



BN 14
31.3.2015 13:50:43
FMX 4181 kN
RMX 3722 kN
CSX 424.0 MPa
CSI 508.7 MPa
TSX 30.1 MPa
EMX 136.2 kN-m
VMX 7.47 m/s
DMX 47 mm
FVP 1.1 []

LE 27.6 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

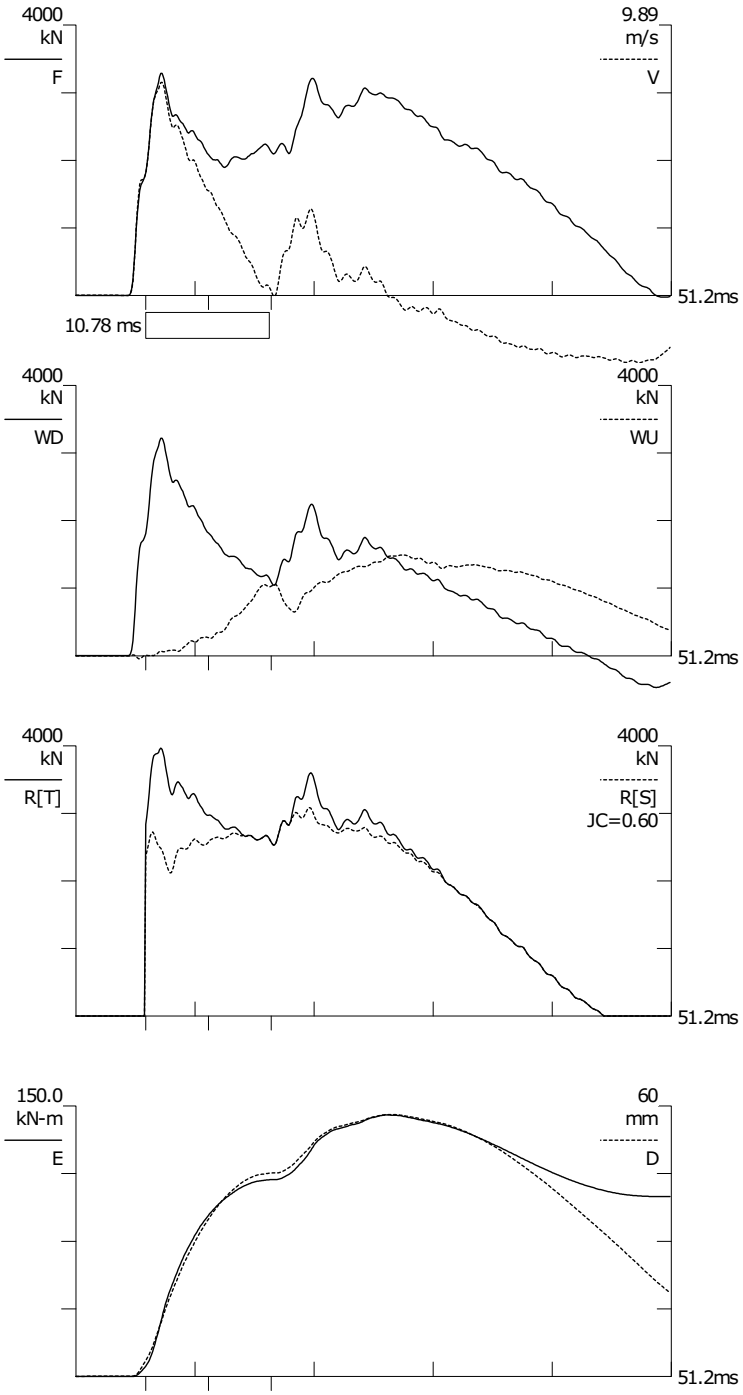
F12 A12

F1: [J246] 91.4 (1)
F2: [J439] 92.1 (1)
A1: [45903] 1165 g's/v (1)
A2: [45906] 1130 g's/v (1)

Tampere University of Technology

Tuuliharjun koepaalutus
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-T1 28vrk
Vapaapudotusjarkale 9t



BN 24
31.3.2015 9:01:39
FMX 3287 kN
RMX 3085 kN
CSX 333.4 MPa
CSI 350.8 MPa
TSX 48.9 MPa
EMX 145.1 kN-m
VMX 7.80 m/s
DMX 58 mm
FVP 1.0 []

LE 27.6 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

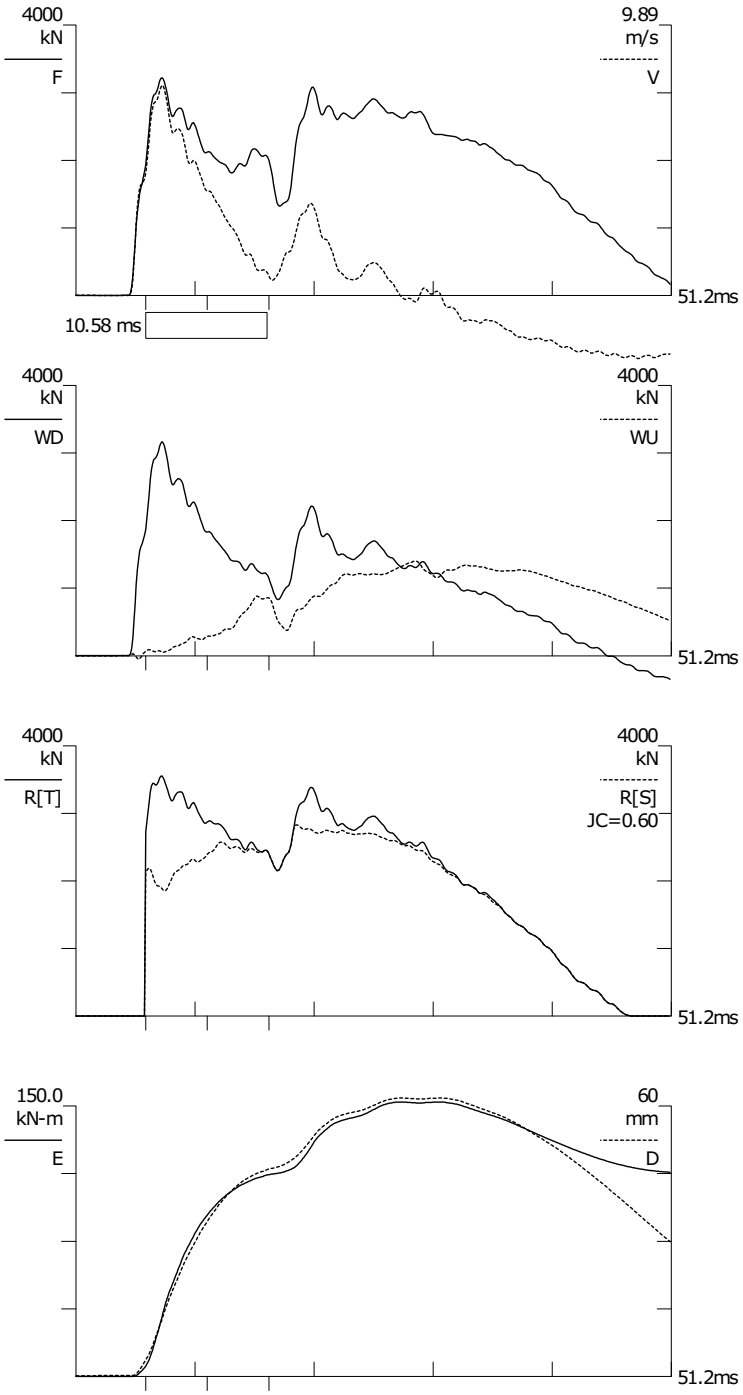
F12 A12

F1: [J246] 91.4 (1)
F2: [J439] 92.1 (1)
A1: [45903] 1165 g's/v (1)
A2: [45906] 1130 g's/v (1)

Tampere University of Technology

Tuuliharjun koepaalutus
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-T2 28vrk
Vapaapudotusjarkale 9t



BN 7
31.3.2015 9:43:23
FMX 3223 kN
RMX 2830 kN
CSX 326.8 MPa
CSI 384.7 MPa
TSX 33.4 MPa
EMX 152.3 kN-m
VMX 7.70 m/s
DMX 62 mm
FVP 1.1 []

LE 27.1 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F12 A12

F1: [J246] 91.4 (1)
F2: [J439] 92.1 (1)
A1: [45903] 1165 g's/v (1)
A2: [45906] 1130 g's/v (1)

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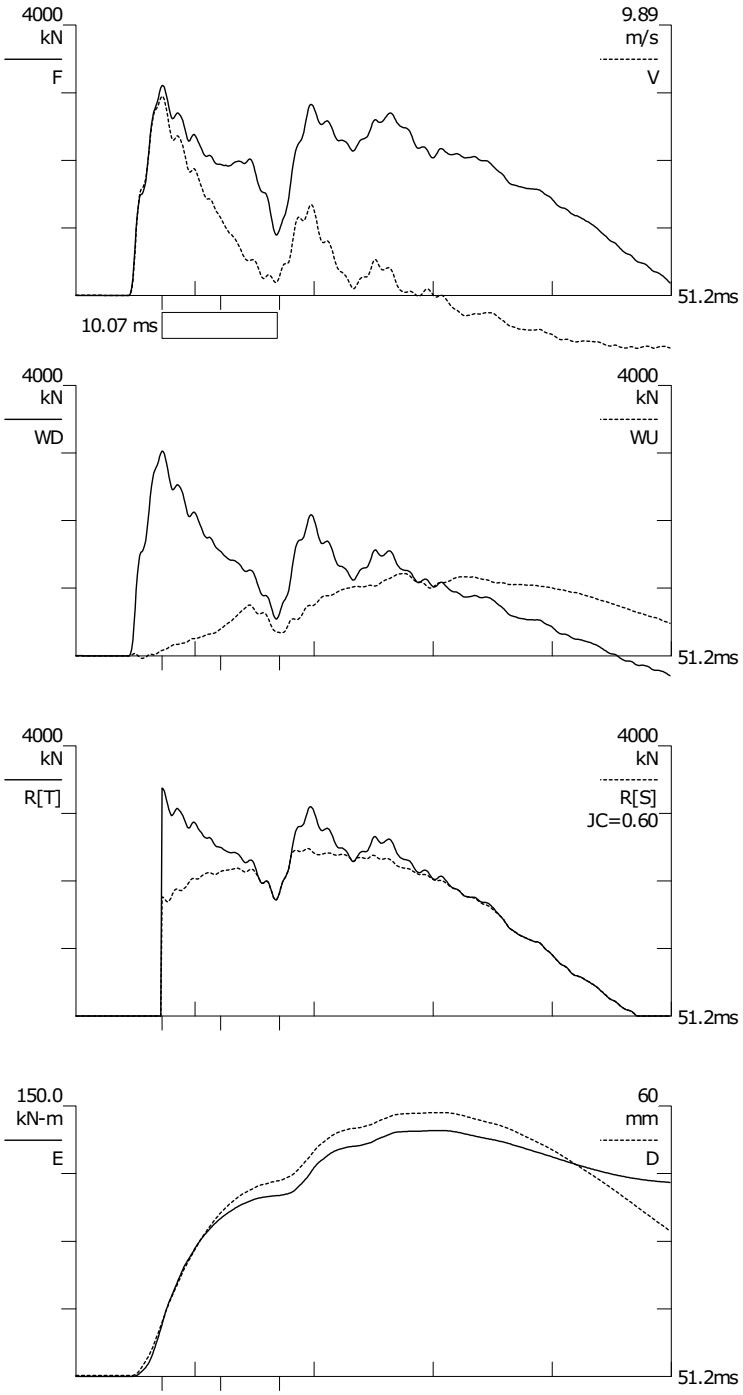
Tuuliharjun koepaalutus
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-T3 28vrk
Vapaapudotusjarkale 9t



BN 18
31.3.2015 9:19:32
FMX 3110 kN
RMX 2479 kN
CSX 315.3 MPa
CSI 331.2 MPa
TSX 29.5 MPa
EMX 136.4 kN-m
VMX 7.30 m/s
DMX 59 mm
FVP 1.1 []

LE 25.8 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F12 A12

F1: [J246] 91.4 (1)
F2: [J439] 92.1 (1)
A1: [45903] 1165 g's/v (1)
A2: [45906] 1130 g's/v (1)

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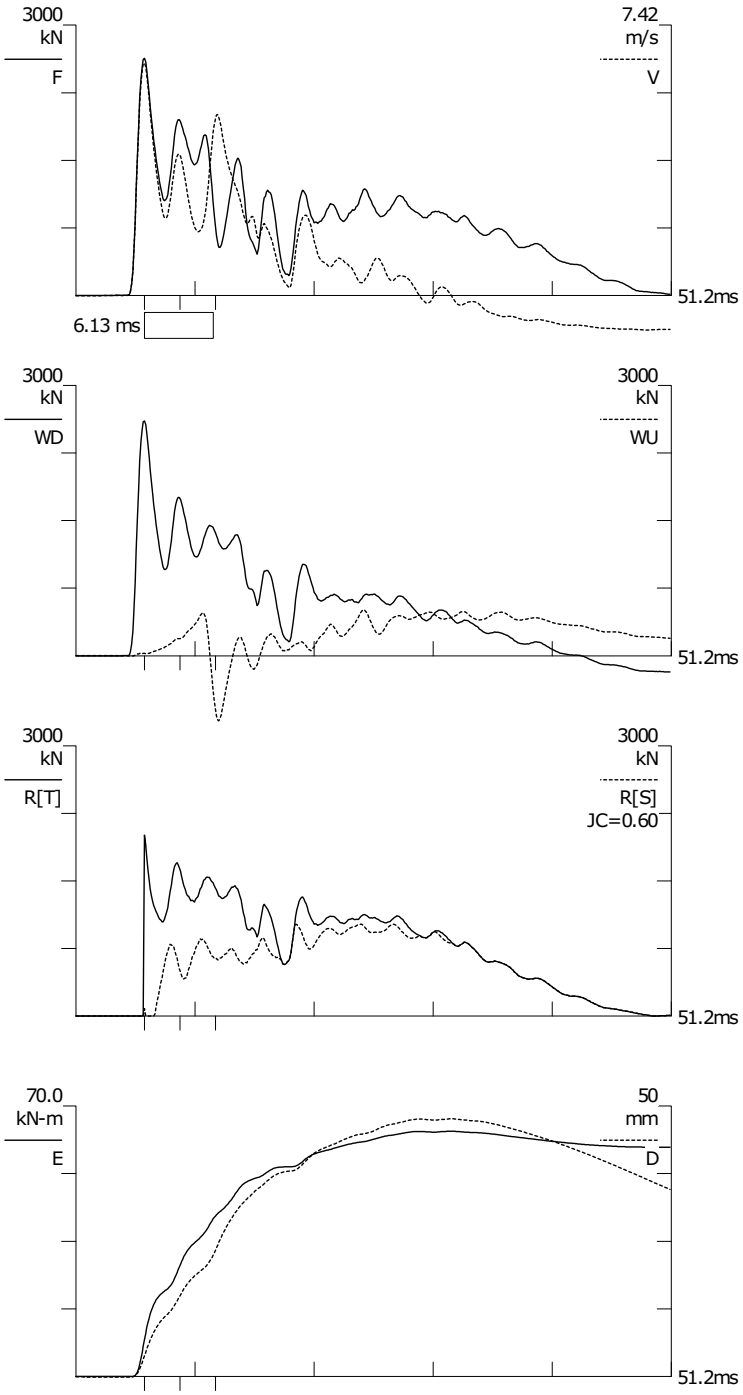
Koepaalutus Zatelliitti
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZPT4 valimittaus
Junttan HHK 5A



BN 6
2.3.2015 9:23:32
FMX 2633 kN
RMX 1022 kN
CSX 267.0 MPa
CSI 268.6 MPa
TSX 0.8 MPa
EMX 63.5 kN-m
VMX 6.38 m/s
DMX 48 mm
FVP 1.0 []

LE 15.7 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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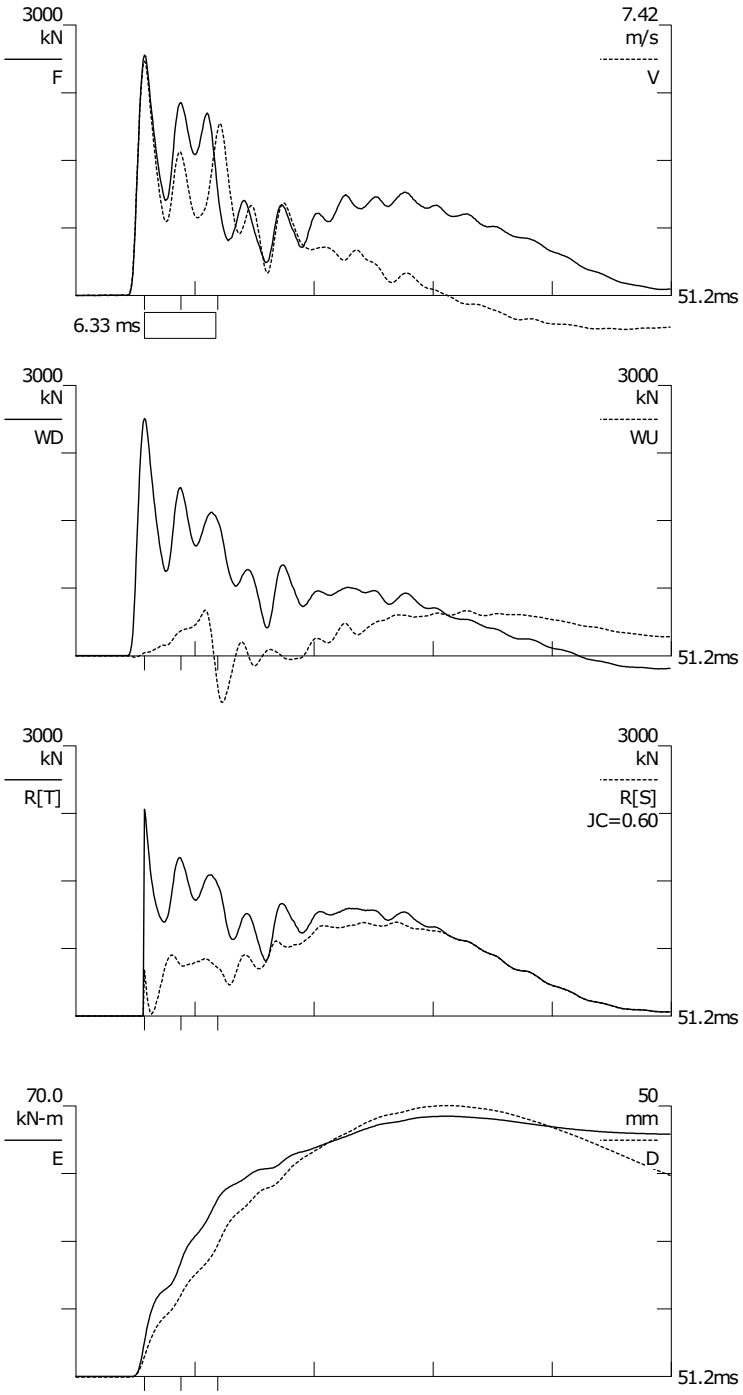
Koepaalutus Zatelliitti
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZPT5 valimittaus
Junttan HHK 5A



BN 15
2.3.2015 9:49:21
FMX 2670 kN
RMX 1043 kN
CSX 270.8 MPa
CSI 273.8 MPa
TSX 4.9 MPa
EMX 67.4 kN-m
VMX 6.43 m/s
DMX 50 mm
FVP 1.0 []

LE 16.2 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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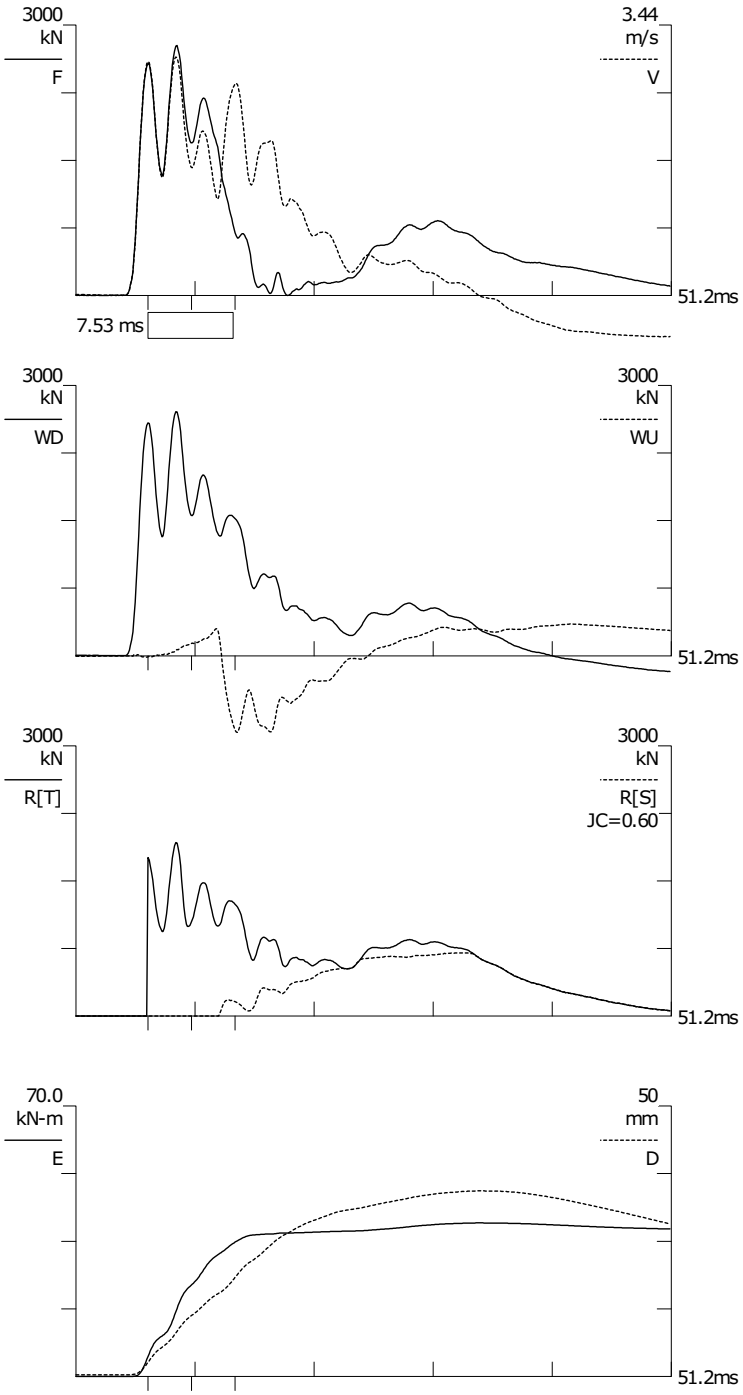
PILE DRIVING ANALYZER ®
Version 2009.098.053

Koepaalutus Zatelliitti
PDA OP: TRe

ZPB3 valimittaus
Junttan HHK 5A



BN 13
2.3.2015 16:02:21
FMX 2774 kN
RMX 703 kN
CSX 30.8 MPa
CSI 34.0 MPa
TSX 1.1 MPa
EMX 39.7 kN-m
VMX 3.04 m/s
DMX 34 mm
FVP 1.0 []

LE 14.3 m
AR 900.00 cm^2
EM 36812 MPa
SP 25.0 kN/m3
WS 3800.0 m/s
EA/C 872 kN-s/m

F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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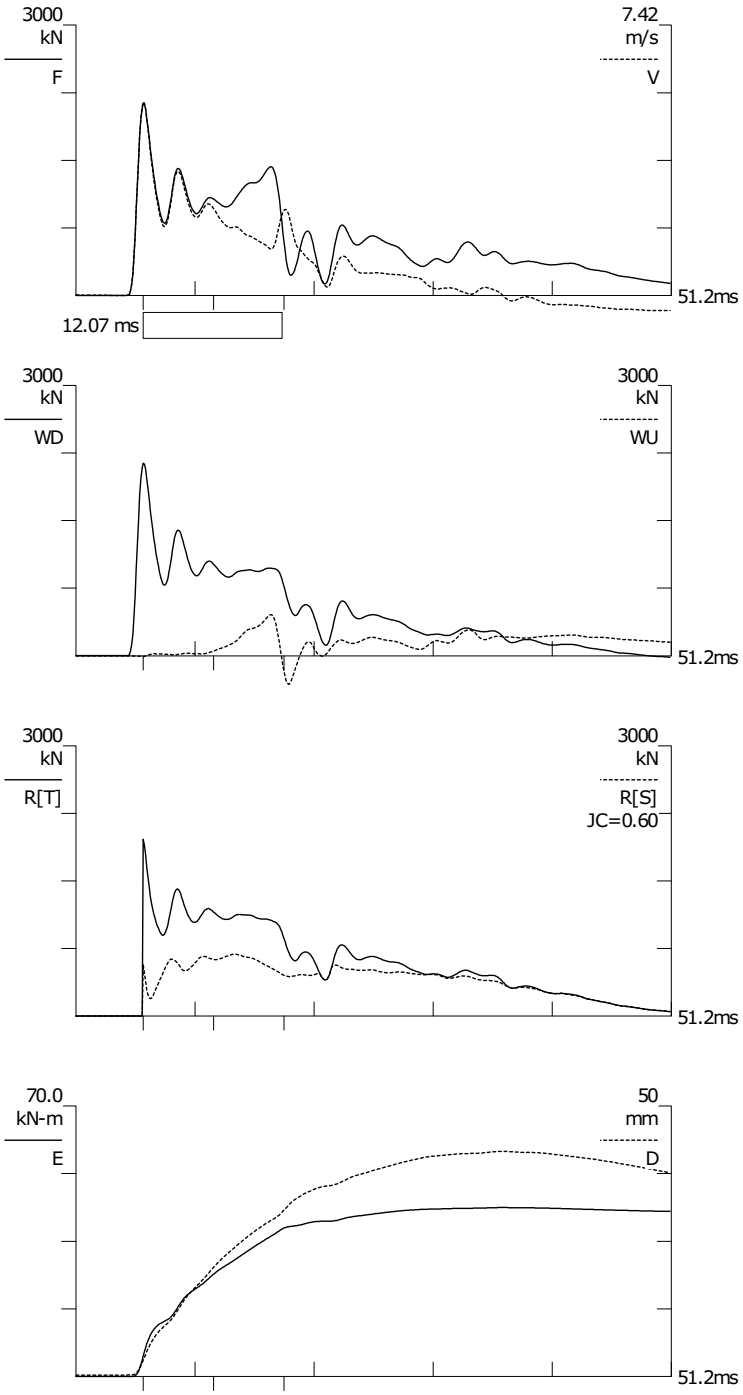
Koepaalutus Zatelliitti
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
ZET1 valimittaus
Junttan HHK 5A



BN 5
3.3.2015 11:44:18
FMX 2126 kN
RMX 687 kN
CSX 215.6 MPa
CSI 237.3 MPa
TSX 0.2 MPa
EMX 43.7 kN-m
VMX 5.32 m/s
DMX 42 mm
FVP 1.0 []

LE 30.9 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m
LP 15.0 m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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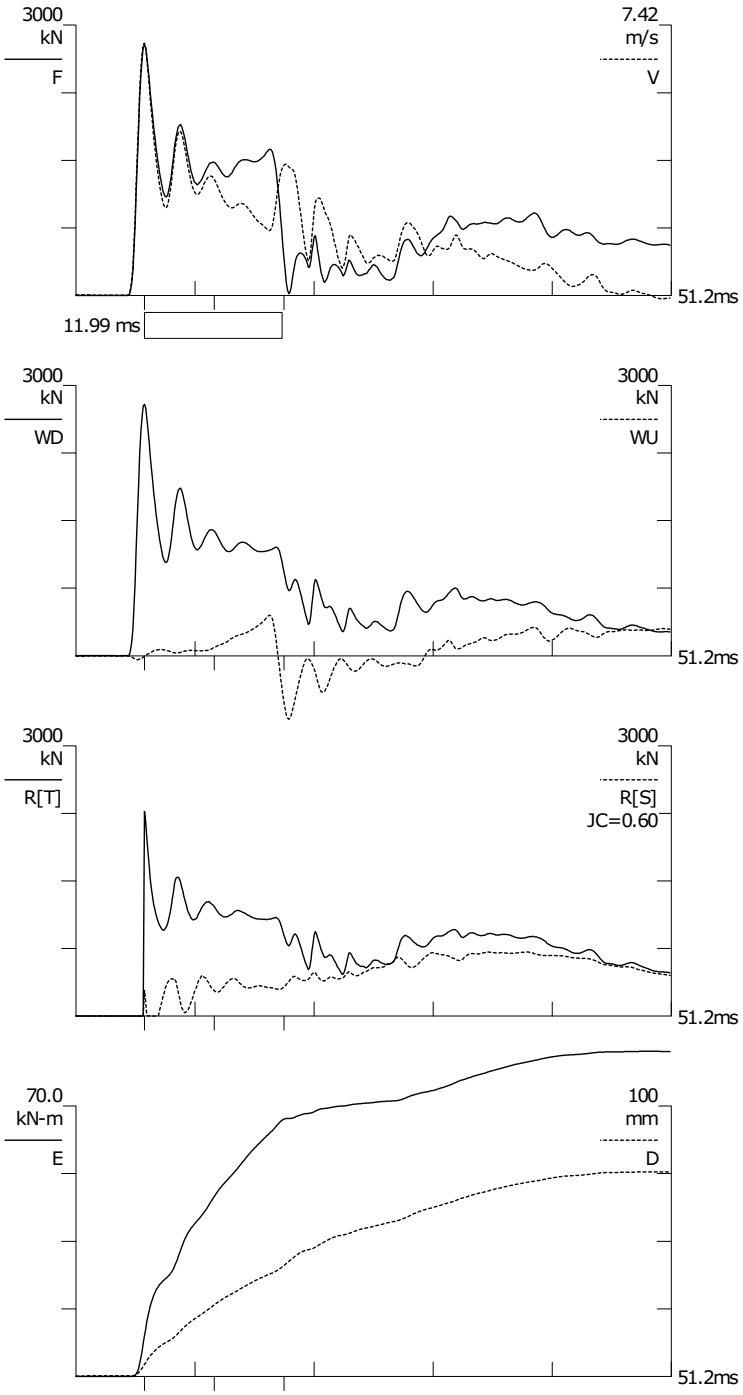
Koepaalutus Tuuliharju
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-T1 valimittaus
Junttan HHK 5A



BN 6
4.3.2015 9:04:31
FMX 2780 kN
RMX 712 kN
CSX 281.9 MPa
CSI 284.7 MPa
TSX 6.1 MPa
EMX 84.2 kN-m
VMX 6.92 m/s
DMX 76 mm
FVP 1.0 []

LE 30.7 m
AR 98.61 cm^2
EM 210000 MPa
SP 78.5 kN/m3
WS 5121.9 m/s
EA/C 404 kN-s/m
LP 15.0 m

F1234 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
F3: [J372] 90.6 (1)
F4: [6476] 95.3 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

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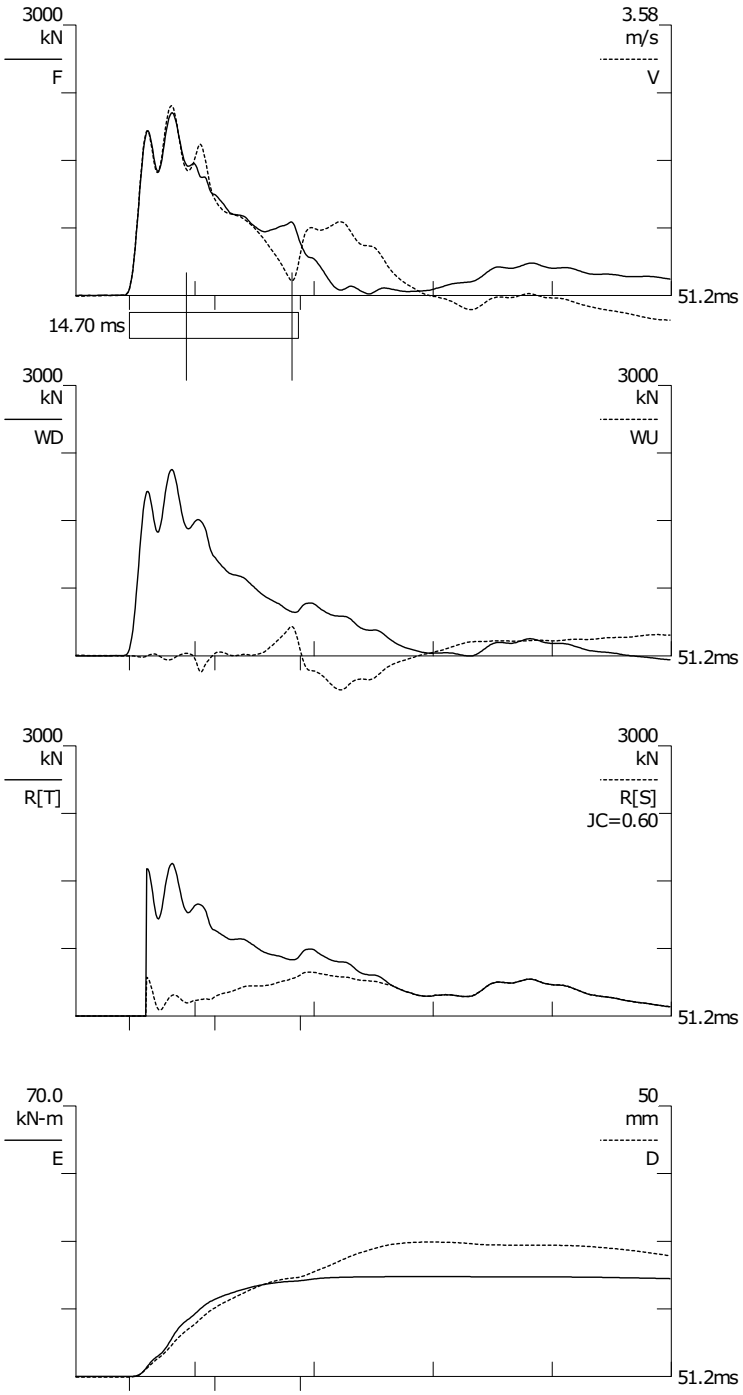
Koepaalutus Tuuliharju
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-B1 valimittaus
Junttan HHK 5A



BN 7
4.3.2015 14:07:07
FMX 2030 kN
RMX 488 kN
CSX 22.6 MPa
CSI 26.0 MPa
TSX 0.2 MPa
EMX 25.9 kN-m
VMX 2.52 m/s
DMX 25 mm
FVP 1.0 []

LE 25.9 m
AR 900.00 cm^2
EM 33963 MPa
SP 25.0 kN/m3
WS 3650.0 m/s
EA/C 837 kN-s/m
LP 14.0 m

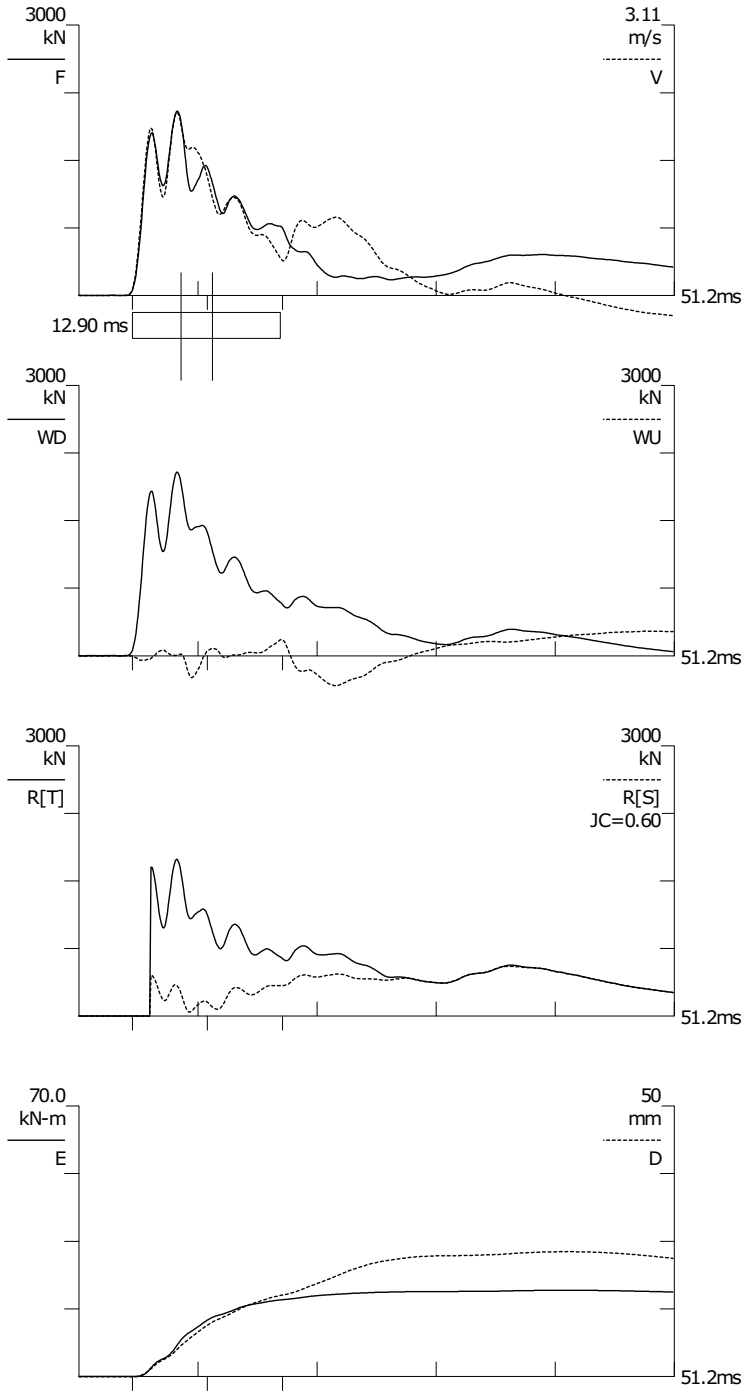
F12 A12

F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)

Tampere University of Technology

Koepaalutus Tuuliharju
PDA OP: TRe

PILE DRIVING ANALYZER ®
Version 2009.098.053
TU-B2 valimittaus
Junttan HHK 5A

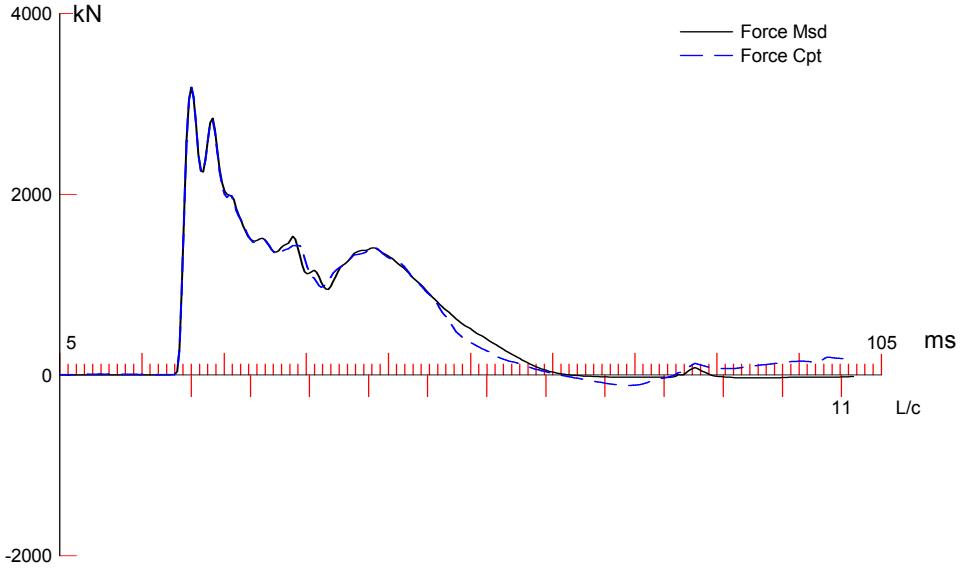


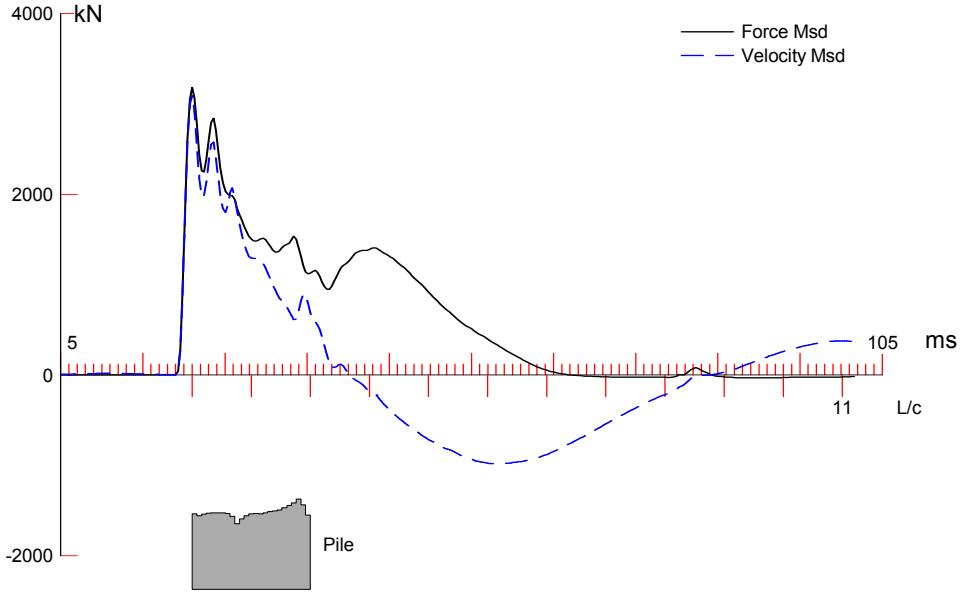
BN 32
4.3.2015 14:52:01
FMX 2048 kN
RMX 540 kN
CSX 22.8 MPa
CSI 23.5 MPa
TSX 1.1 MPa
EMX 22.3 kN-m
VMX 2.11 m/s
DMX 23 mm
FVP 1.0 []

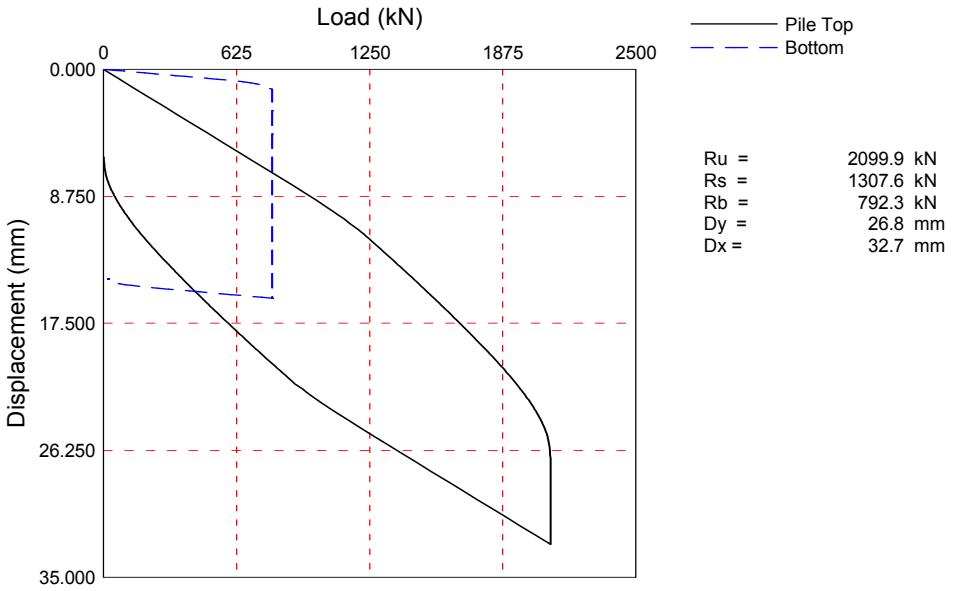
LE 24.0 m
AR 900.00 cm^2
EM 44969 MPa
SP 25.0 kN/m3
WS 4200.0 m/s
EA/C 964 kN-s/m
LP 15.0 m

F12 A12

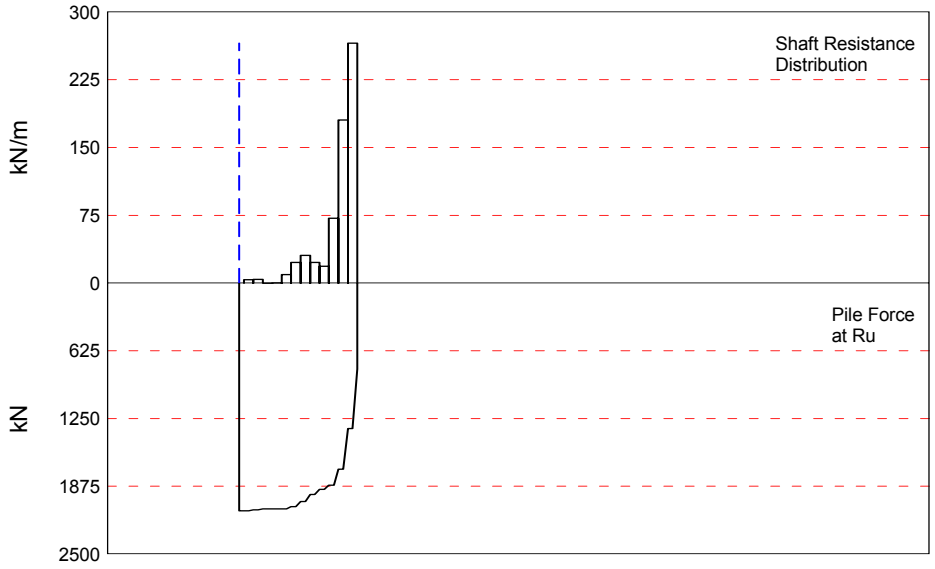
F1: [J583] 92 (1)
F2: [J931] 91.2 (1)
A1: [45900] 1160 g's/v (1)
A2: [45901] 1150 g's/v (1)







Ru =	2099.9	kN
Rs =	1307.6	kN
Rb =	792.3	kN
Dy =	26.8	mm
Dx =	32.7	mm



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Zatelliitin koepaalutus 14vrk; Pile: TU-B1 14 vrk Test: 18-Mar-2015 15:11:
Junttan HHK 7A; Blow: 7 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2099.9; along Shaft 1307.6; at Toe 792.3 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				2099.9				
1	3.1	3.1	8.1	2091.8	8.1	2.61	2.17	0.075
2	5.2	5.2	8.8	2083.0	16.9	4.25	3.54	0.075
3	7.3	7.3	0.0	2083.0	16.9	0.00	0.00	0.000
4	9.3	9.3	0.5	2082.5	17.4	0.24	0.20	0.075
5	11.4	11.4	19.9	2062.6	37.3	9.60	8.00	0.075
6	13.5	13.5	47.4	2015.2	84.7	22.88	19.06	0.075
7	15.5	15.5	63.7	1951.5	148.4	30.74	25.62	0.075
8	17.6	17.6	47.3	1904.2	195.7	22.83	19.02	0.075
9	19.7	19.7	38.8	1865.4	234.5	18.73	15.60	0.075
10	21.8	21.8	148.8	1716.6	383.3	71.81	59.85	0.075
11	23.8	23.8	374.2	1342.4	757.5	180.60	150.50	0.075
12	25.9	25.9	550.1	792.3	1307.6	265.49	221.24	0.075
Avg. Shaft			109.0			50.49	42.07	0.075
Toe			792.3				8803.33	0.729

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	7.500	1.013
Case Damping Factor		0.119	0.699
Damping Type		Smith	
Unloading Quake	(% of loading quake)	100	30
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	4	
Resistance Gap (included in Toe Quake)	(mm)		0.009
Soil Plug Weight	(kN)		0.28
Soil Support Dashpot		0.000	3.402
Soil Support Weight	(kN)	0.00	12.43

CAPWAP match quality = 3.10 (Wave Up Match) ; RSA = 0
Observed: final set = 6.000 mm; blow count = 167 b/m
Computed: final set = 13.816 mm; blow count = 72 b/m

max. Top Comp. Stress = 36.2 MPa (T= 21.6 ms, max= 1.045 x Top)
max. Comp. Stress = 37.8 MPa (Z= 21.8 m, T= 27.9 ms)
max. Tens. Stress = -3.85 MPa (Z= 19.7 m, T= 70.2 ms)
max. Energy (EMX) = 62.51 kJ; max. Measured Top Displ. (DMX)=31.16 mm

Zatelliitin koepaalutus 14vrk; Pile: TU-B1 14 vrk — Test: 18-Mar-2015 15:11:
Junttan HHK 7A; Blow: 7 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3257.7	-128.8	36.2	-1.43	62.51	3.7	30.700
2	2.1	3270.3	-142.1	36.3	-1.58	62.18	3.6	30.225
4	4.1	3273.7	-174.9	36.4	-1.94	61.44	3.6	29.426
6	6.2	3241.7	-208.8	36.0	-2.32	60.57	3.6	28.539
8	8.3	3068.8	-240.6	34.1	-2.67	59.84	3.8	27.571
9	9.3	3121.9	-255.0	34.7	-2.83	59.42	3.7	27.034
10	10.4	3188.1	-266.9	35.4	-2.97	58.88	3.6	26.413
11	11.4	3227.8	-279.7	35.9	-3.11	58.35	3.6	25.804
12	12.4	3229.7	-291.8	35.9	-3.24	57.35	3.6	25.213
13	13.5	3232.1	-304.2	35.9	-3.38	56.82	3.6	24.629
14	14.5	3219.4	-314.1	35.8	-3.49	55.23	3.5	24.059
15	15.5	3234.4	-325.0	35.9	-3.61	54.72	3.5	23.481
16	16.6	3216.0	-332.3	35.7	-3.69	52.85	3.5	22.918
17	17.6	3236.2	-338.9	36.0	-3.77	52.34	3.4	22.352
18	18.6	3261.9	-342.4	36.2	-3.80	50.89	3.4	21.796
19	19.7	3314.2	-346.2	36.8	-3.85	50.41	3.3	21.252
20	20.7	3359.4	-345.7	37.3	-3.84	49.25	3.3	20.749
21	21.8	3403.5	-344.7	37.8	-3.83	48.84	3.2	20.262
22	22.8	3284.4	-335.1	36.5	-3.72	46.17	3.3	19.846
23	23.8	3128.9	-331.1	34.8	-3.68	46.12	3.4	19.443
24	24.9	2942.9	-313.0	32.7	-3.48	41.08	3.5	19.146
25	25.9	2781.2	-311.4	30.9	-3.46	34.27	3.7	18.868
Absolute	21.8			37.8			(T =	27.9 ms)
	19.7				-3.85		(T =	70.2 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3367.1	3072.5	2778.0	2483.4	2188.9	1894.3	1599.8	1305.3	1010.7	716.2
RX	3379.3	3087.5	2795.7	2503.8	2257.3	2032.0	1878.7	1826.0	1776.2	1739.4
RU	3367.1	3072.5	2778.0	2483.4	2188.9	1894.3	1599.8	1305.3	1010.7	716.2

RAU = 1558.2 (kN); RA2 = 2066.6 (kN)

Current CAPWAP Ru = 2099.9 (kN); Corresponding J(RP)= 0.43; J(RX) = 0.47

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
3.77	21.30	3116.5	3196.0	3200.8	31.160	6.020	6.000	63.0	3389.5

PILE PROFILE AND PILE MODEL

Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	900.00	33038.8	25.000	1.200
25.90	900.00	33038.8	25.000	1.200

Zatelliitin koepaalutus 14vrk; Pile: TU-B1 14 vrk Test: 18-Mar-2015 15:11:
Junttan HHK 7A; Blow: 7 CAPWAP(R) 2006-2
Inspecta OP: TRe

Toe Area 0.090 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.04	825.97	0.00	0.000	0.000	-0.000	0.000	1.200	0.00
2	2.07	805.87	-2.43	0.000	0.000	-0.000	0.000	1.200	0.21
3	3.11	821.67	-0.52	0.000	0.000	-0.000	0.000	1.200	0.22
4	4.14	831.87	0.71	0.000	0.000	-0.000	0.000	1.200	0.22
5	5.18	833.97	0.97	0.000	0.000	-0.000	0.000	1.200	0.22
6	6.22	835.17	1.11	0.000	0.000	-0.000	0.000	1.200	0.22
7	7.25	834.47	1.03	0.000	0.000	-0.000	0.000	1.200	0.22
8	8.29	830.17	0.51	0.000	0.000	-0.000	0.000	1.200	0.22
9	9.32	797.57	-3.44	0.000	0.000	-0.000	0.000	1.200	0.22
10	10.36	715.97	-13.32	0.000	0.000	-0.000	0.000	1.200	0.22
11	11.40	768.97	-6.90	0.000	0.000	-0.000	0.000	1.200	0.22
12	12.43	805.07	-2.53	0.000	0.000	-0.000	0.000	1.200	0.22
13	13.47	826.57	0.07	0.000	0.000	-0.000	0.000	1.200	0.22
14	14.50	828.47	0.30	0.000	0.000	-0.000	0.000	1.200	0.22
15	15.54	825.77	-0.02	0.000	0.000	-0.000	0.000	1.200	0.22
16	16.58	834.77	1.07	0.000	0.000	-0.000	0.000	1.200	0.22
17	17.61	849.47	2.85	0.000	0.000	-0.000	0.000	1.200	0.22
18	18.65	857.87	3.86	0.000	0.000	-0.000	0.000	1.200	0.22
19	19.68	866.07	4.85	0.000	0.000	-0.000	0.000	1.200	0.22
20	20.72	890.47	7.81	0.000	0.000	-0.000	0.000	1.200	0.22
21	21.76	916.07	10.91	0.000	0.000	-0.000	0.000	1.200	0.22
22	22.79	943.87	14.27	0.000	0.000	-0.000	0.000	1.200	0.22
23	23.83	985.67	19.33	0.000	0.000	-0.000	0.000	1.200	0.22
24	24.86	924.17	11.89	0.000	0.000	-0.000	0.000	1.200	0.22
25	25.90	810.27	-1.90	0.000	0.000	-0.000	0.000	1.200	0.22

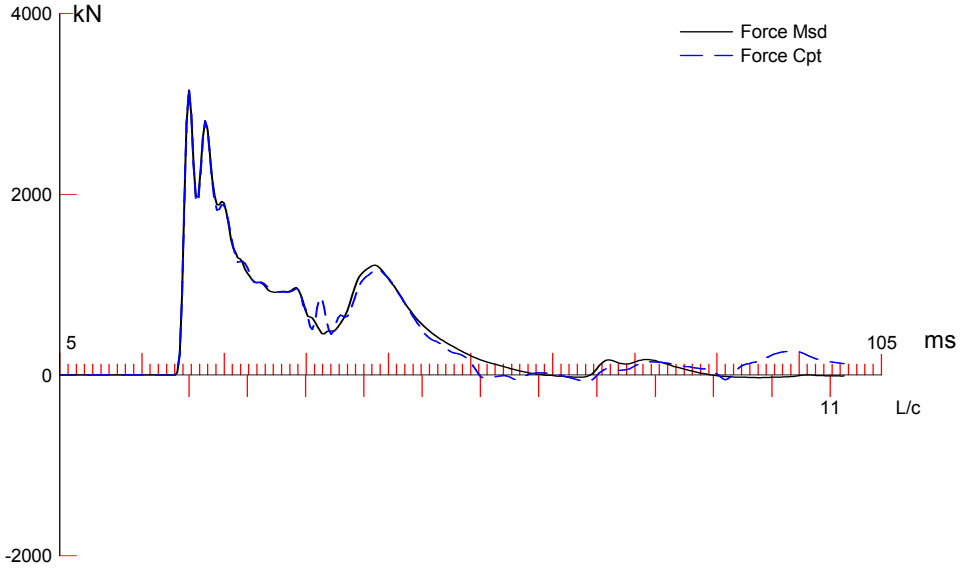
Pile Damping 2.0 %, Time Incr 0.288 ms, Wave Speed 3600.0 m/s, 2L/c 14.4 ms

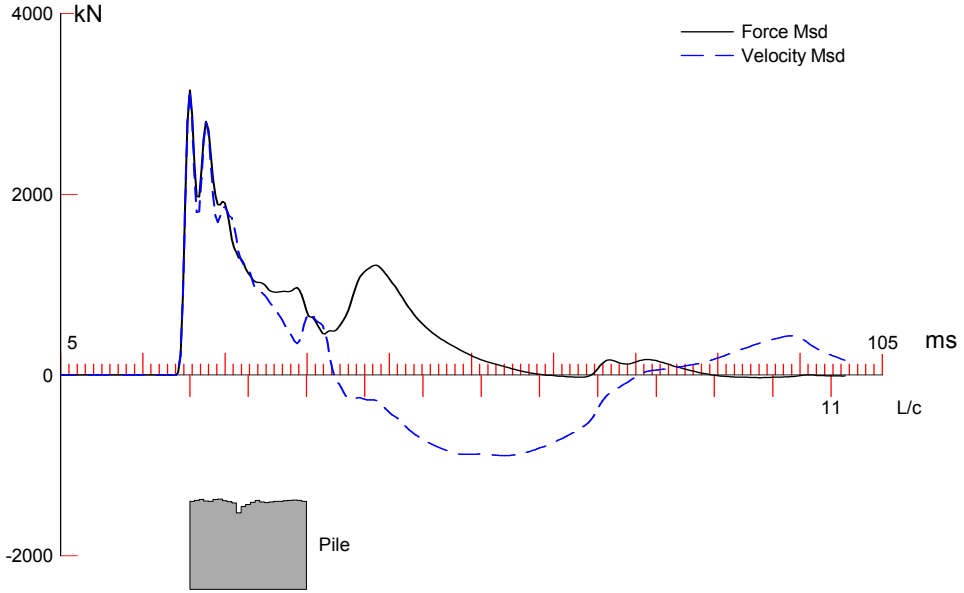
Koepaalutus Tuuliharju; Pile: TU-B1 24h; Junttan HHK 5A; Blow: 12 (Test: 05-Mar-2015 10:25:)

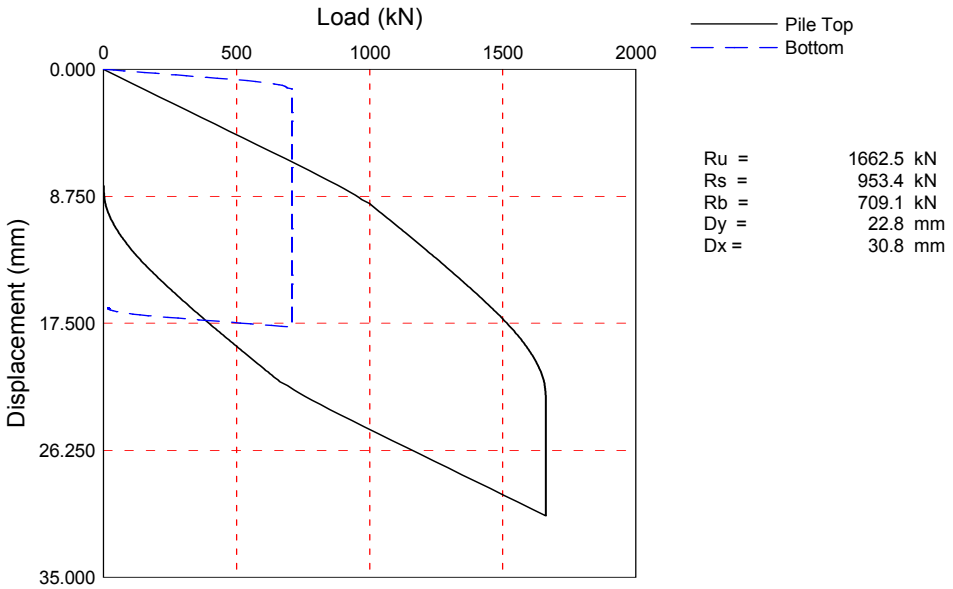
Inspecta

25-Mar-2015

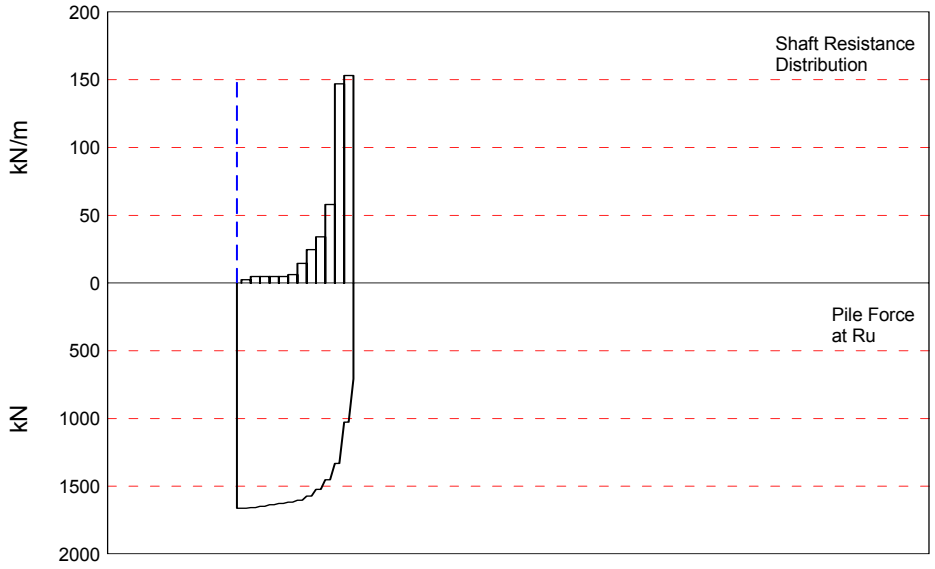
CAPWAP(R) 2006-2







Ru =	1662.5	kN
Rs =	953.4	kN
Rb =	709.1	kN
Dy =	22.8	mm
Dx =	30.8	mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Koepaalutus Tuuliharju; Pile: TU-B1 24h — Test: 05-Mar-2015 10:25:
Junttan HHK 5A; Blow: 12 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1662.5; along Shaft 953.4; at Toe 709.1 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				1662.5				
1	3.1	3.1	5.2	1657.3	5.2	1.67	1.39	0.184
2	5.2	5.2	10.2	1647.1	15.4	4.92	4.10	0.184
3	7.3	7.3	10.2	1636.9	25.6	4.92	4.10	0.184
4	9.3	9.3	10.2	1626.7	35.8	4.92	4.10	0.184
5	11.4	11.4	10.2	1616.5	46.0	4.92	4.10	0.184
6	13.5	13.5	12.9	1603.6	58.9	6.23	5.19	0.184
7	15.5	15.5	30.3	1573.3	89.2	14.62	12.19	0.184
8	17.6	17.6	51.1	1522.2	140.3	24.66	20.55	0.184
9	19.7	19.7	71.0	1451.2	211.3	34.27	28.56	0.184
10	21.8	21.8	120.3	1330.9	331.6	58.06	48.38	0.184
11	23.8	23.8	304.4	1026.5	636.0	146.91	122.43	0.184
12	25.9	25.9	317.4	709.1	953.4	153.19	127.65	0.184
Avg. Shaft			79.5			36.81	30.68	0.184
Toe			709.1				7878.89	0.434

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	7.500	1.021
Case Damping Factor		0.209	0.367
Damping Type			Smith
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	29	
Resistance Gap (included in Toe Quake)	(mm)		0.017
Soil Plug Weight	(kN)		1.77
Soil Support Dashpot		0.000	3.982
Soil Support Weight	(kN)	0.00	12.43

CAPWAP match quality = 3.50 (Wave Up Match) ; RSA = 0
Observed: final set = 8.000 mm; blow count = 125 b/m
Computed: final set = 12.351 mm; blow count = 81 b/m

max. Top Comp. Stress = 35.5 MPa (T= 21.3 ms, max= 1.000 x Top)
max. Comp. Stress = 35.5 MPa (Z= 1.0 m, T= 21.3 ms)
max. Tens. Stress = -3.55 MPa (Z= 17.6 m, T= 69.3 ms)
max. Energy (EMX) = 46.23 kJ; max. Measured Top Displ. (DMX)=26.54 mm

Koepaalutus Tuuliharju; Pile: TU-B1 24h — Test: 05-Mar-2015 10:25:
Junttan HHK 5A; Blow: 12 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3198.0	-97.2	35.5	-1.08	46.23	3.7	26.074
2	2.1	3175.8	-125.9	35.3	-1.40	46.12	3.7	25.835
4	4.1	3157.9	-178.2	35.1	-1.98	45.64	3.7	25.250
6	6.2	3137.4	-219.6	34.9	-2.44	45.02	3.7	24.651
8	8.3	3061.5	-250.0	34.0	-2.78	44.33	3.7	23.971
9	9.3	2964.6	-265.0	32.9	-2.94	44.10	3.8	23.590
10	10.4	2909.3	-274.6	32.3	-3.05	43.55	3.8	23.185
11	11.4	2970.5	-284.8	33.0	-3.16	43.24	3.7	22.703
12	12.4	2986.8	-290.6	33.2	-3.23	42.65	3.6	22.247
13	13.5	3008.0	-300.7	33.4	-3.34	42.34	3.6	21.793
14	14.5	2993.6	-305.3	33.3	-3.39	41.69	3.5	21.344
15	15.5	2969.0	-314.6	33.0	-3.50	41.39	3.5	20.906
16	16.6	2935.4	-310.9	32.6	-3.45	40.36	3.5	20.480
17	17.6	2946.8	-319.6	32.7	-3.55	40.07	3.4	20.043
18	18.6	2923.4	-306.1	32.5	-3.40	38.59	3.4	19.617
19	19.7	2949.3	-311.7	32.8	-3.46	38.29	3.4	19.181
20	20.7	2919.8	-288.7	32.4	-3.21	36.44	3.4	18.756
21	21.8	2957.3	-291.1	32.9	-3.23	36.14	3.3	18.328
22	22.8	2912.5	-246.6	32.4	-2.74	33.37	3.5	17.932
23	23.8	2895.8	-246.3	32.2	-2.74	33.11	3.3	17.533
24	24.9	2409.3	-129.1	26.8	-1.43	27.08	3.6	17.283
25	25.9	2269.4	-125.9	25.2	-1.40	21.23	3.8	17.087
Absolute	1.0			35.5			(T =	21.3 ms)
	17.6				-3.55		(T =	69.3 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3218.5	2896.5	2574.5	2252.5	1930.5	1608.5	1286.5	964.5	642.5	320.5
RX	3218.5	2896.5	2574.5	2252.5	1930.5	1652.0	1607.8	1568.7	1546.7	1525.0
RU	3218.5	2896.5	2574.5	2252.5	1930.5	1608.5	1286.5	964.5	642.5	320.5

RAU = 1333.6 (kN); RA2 = 1613.6 (kN)

Current CAPWAP Ru = 1662.5 (kN); Corresponding J(RP)= 0.48; J(RX) = 0.50

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
3.84	21.00	3215.8	3222.7	3222.7	26.542	8.007	8.000	46.6	2698.9

PILE PROFILE AND PILE MODEL

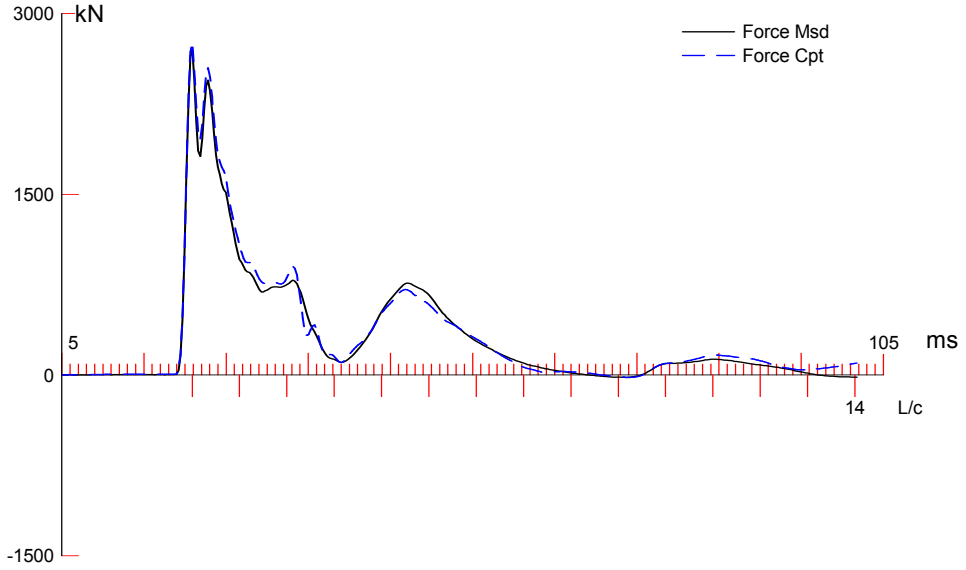
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	900.00	33962.9	25.000	1.200
25.90	900.00	33962.9	25.000	1.200

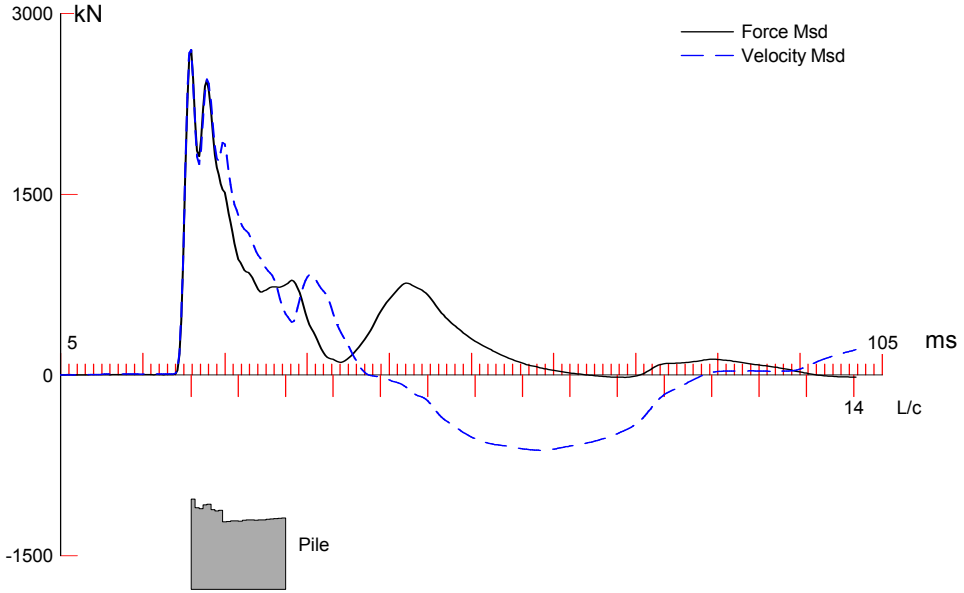
Koepaalutus Tuuliharju; Pile: TU-B1 24h — Test: 05-Mar-2015 10:25:
Junttan HHK 5A; Blow: 12 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

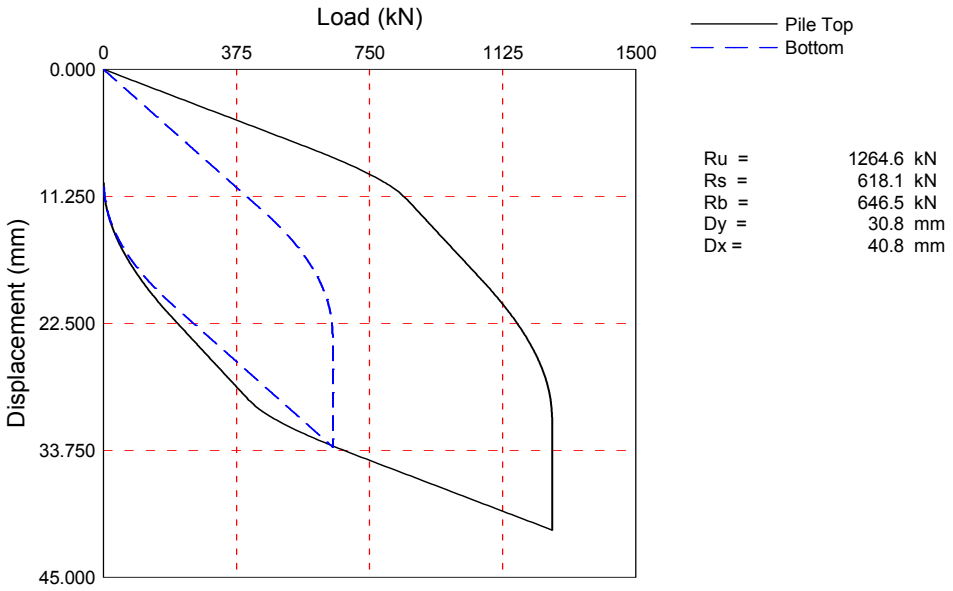
Toe Area 0.090 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.04	837.44	0.00	0.000	0.000	-0.000	0.000	1.200	0.00
2	2.07	846.54	1.09	0.000	0.000	-0.000	0.000	1.200	0.05
3	3.11	853.44	1.91	0.000	0.000	-0.000	0.000	1.200	0.03
4	4.14	838.54	0.13	0.000	0.000	-0.000	0.000	1.200	0.03
5	5.18	836.94	-0.06	0.000	0.000	-0.000	0.000	1.200	0.03
6	6.22	853.94	1.97	0.000	0.000	-0.000	0.000	1.200	0.03
7	7.25	856.74	2.30	0.000	0.000	-0.000	0.000	1.200	0.03
8	8.29	842.14	0.56	0.000	0.000	-0.000	0.000	1.200	0.03
9	9.32	831.54	-0.70	0.000	0.000	-0.000	0.000	1.200	0.03
10	10.36	822.04	-1.84	0.000	1.000	-0.000	0.000	1.200	0.03
11	11.40	726.74	-13.22	0.000	0.000	-0.000	0.000	1.200	0.03
12	12.43	786.14	-6.13	0.000	0.000	-0.000	0.000	1.200	0.03
13	13.47	806.14	-3.74	0.000	0.000	-0.000	0.000	1.200	0.03
14	14.50	826.54	-1.30	0.000	0.000	-0.000	0.000	1.200	0.03
15	15.54	844.44	0.84	0.000	0.000	-0.000	0.000	1.200	0.03
16	16.58	830.44	-0.84	0.000	0.000	-0.000	0.000	1.200	0.03
17	17.61	823.94	-1.61	0.000	0.000	-0.000	0.000	1.200	0.03
18	18.65	829.64	-0.93	0.000	0.000	-0.000	0.000	1.200	0.03
19	19.68	835.94	-0.18	0.000	0.000	-0.000	0.000	1.200	0.03
20	20.72	836.94	-0.06	0.000	0.000	-0.000	0.000	1.200	0.03
21	21.76	841.24	0.45	0.000	0.000	-0.000	0.000	1.200	0.03
22	22.79	845.04	0.91	0.000	0.000	-0.000	0.000	1.200	0.03
23	23.83	847.44	1.19	0.000	0.000	-0.000	0.000	1.200	0.03
24	24.86	845.74	0.99	0.000	0.000	-0.000	0.000	1.200	0.03
25	25.90	837.24	-0.02	0.000	0.000	-0.000	0.000	1.200	0.03

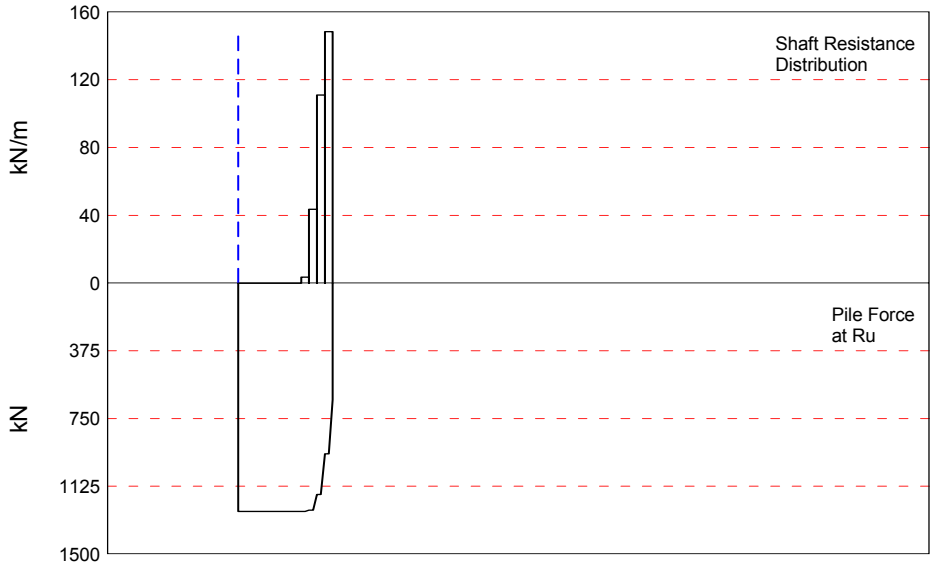
Pile Damping 2.0 %, Time Incr 0.284 ms, Wave Speed 3650.0 m/s, 2L/c 14.2 ms







Ru =	1264.6	kN
Rs =	618.1	kN
Rb =	646.5	kN
Dy =	30.8	mm
Dx =	40.8	mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Koepaalutus Tuuliharju; Pile: TU-B2 24h — Test: 05-Mar-2015 10:17:
Junttan HHK 5A; Blow: 5 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1264.6; along Shaft 618.1; at Toe 646.5 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m	Quake mm
				1264.6					
1	2.0	2.0	0.0	1264.6	0.0	0.00	0.00	0.000	6.703
2	4.0	4.0	0.0	1264.6	0.0	0.00	0.00	0.000	6.704
3	6.0	6.1	0.0	1264.6	0.0	0.00	0.00	0.000	6.704
4	8.1	8.1	0.0	1264.6	0.0	0.00	0.00	0.000	6.704
5	10.1	10.1	0.0	1264.6	0.0	0.00	0.00	0.000	6.704
6	12.1	12.1	0.0	1264.6	0.0	0.00	0.00	0.000	6.704
7	14.1	14.1	0.0	1264.6	0.0	0.00	0.00	0.000	6.704
8	16.1	16.1	0.0	1264.6	0.0	0.00	0.00	0.000	6.704
9	18.1	18.1	7.2	1257.4	7.2	3.57	2.98	1.008	5.953
10	20.2	20.2	87.9	1169.5	95.1	43.59	36.32	1.008	5.564
11	22.2	22.2	223.9	945.6	319.0	111.02	92.52	1.008	5.238
12	24.2	24.2	299.1	646.5	618.1	148.31	123.60	1.008	5.059
Avg. Shaft			51.5			25.54	21.28	1.008	5.206
Toe			646.5				7183.33	0.220	18.046

Soil Model Parameters/Extensions		Shaft	Toe
Case Damping Factor		0.647	0.148
Unloading Quake	(% of loading quake)	300	59
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	48	
Resistance Gap (included in Toe Quake)	(mm)		3.044
Soil Plug Weight	(kN)		0.71
Soil Support Dashpot		0.300	10.000
Soil Support Weight	(kN)	12.10	12.10

CAPWAP match quality = 2.99 (Wave Up Match) ; RSA = 0
Observed: final set = 10.000 mm; blow count = 100 b/m
Computed: final set = 7.302 mm; blow count = 137 b/m

max. Top Comp. Stress = 31.6 MPa (T= 21.4 ms, max= 1.011 x Top)
max. Comp. Stress = 32.0 MPa (Z= 3.0 m, T= 21.8 ms)
max. Tens. Stress = -1.94 MPa (Z= 20.2 m, T= 75.9 ms)
max. Energy (EMX) = 32.53 kJ; max. Measured Top Displ. (DMX)=24.51 mm

Koepaalutus Tuuliharju; Pile: TU-B2 24h — Test: 05-Mar-2015 10:17:
Junttan HHK 5A; Blow: 5 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2846.5	-30.0	31.6	-0.33	32.53	2.7	23.250
2	2.0	2843.5	-38.5	31.6	-0.43	32.51	2.7	23.162
4	4.0	2855.2	-62.4	31.7	-0.69	32.51	2.7	22.977
6	6.0	2759.1	-86.6	30.7	-0.96	32.49	2.7	22.763
7	7.1	2685.8	-98.2	29.8	-1.09	32.48	2.8	22.638
8	8.1	2643.0	-110.5	29.4	-1.23	32.46	2.9	22.505
9	9.1	2639.3	-121.5	29.3	-1.35	32.41	2.9	22.337
10	10.1	2612.2	-130.8	29.0	-1.45	32.37	2.9	22.161
11	11.1	2638.6	-137.7	29.3	-1.53	32.32	2.9	21.978
12	12.1	2652.7	-144.9	29.5	-1.61	32.27	2.9	21.785
13	13.1	2646.3	-151.7	29.4	-1.69	32.20	2.8	21.579
14	14.1	2632.5	-156.3	29.2	-1.74	32.12	2.9	21.360
15	15.1	2654.9	-161.4	29.5	-1.79	32.04	2.9	21.131
16	16.1	2656.3	-165.2	29.5	-1.84	31.95	2.8	20.891
17	17.1	2634.3	-168.0	29.3	-1.87	31.86	2.8	20.646
18	18.1	2712.2	-170.6	30.1	-1.90	31.78	2.8	20.404
19	19.2	2707.7	-172.6	30.1	-1.92	31.34	2.8	20.169
20	20.2	2761.0	-174.4	30.7	-1.94	31.29	2.9	19.936
21	21.2	2649.9	-159.9	29.4	-1.78	27.52	3.1	19.722
22	22.2	2771.5	-161.6	30.8	-1.80	27.44	2.8	19.502
23	23.2	2084.0	-110.2	23.2	-1.22	19.73	2.8	19.291
24	24.2	1609.9	-112.4	17.9	-1.25	10.27	3.3	19.072
Absolute	3.0			32.0			(T =	21.8 ms)
	20.2				-1.94		(T =	75.9 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	2684.5	2399.8	2115.0	1830.2	1545.5	1260.7	976.0	691.2	406.4	121.7
RX	2684.5	2399.8	2115.0	1830.2	1545.5	1260.7	979.9	958.4	937.0	915.5
RU	2684.5	2399.8	2115.0	1830.2	1545.5	1260.7	976.0	691.2	406.4	121.7

RAU = 870.7 (kN); RA2 = 1023.3 (kN)

Current CAPWAP Ru = 1264.6 (kN); Corresponding J(RP)= 0.50; J(RX) = 0.50

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
2.88	21.13	2773.0	2759.1	2759.1	24.514	10.011	10.000	32.7	1894.6

PILE PROFILE AND PILE MODEL

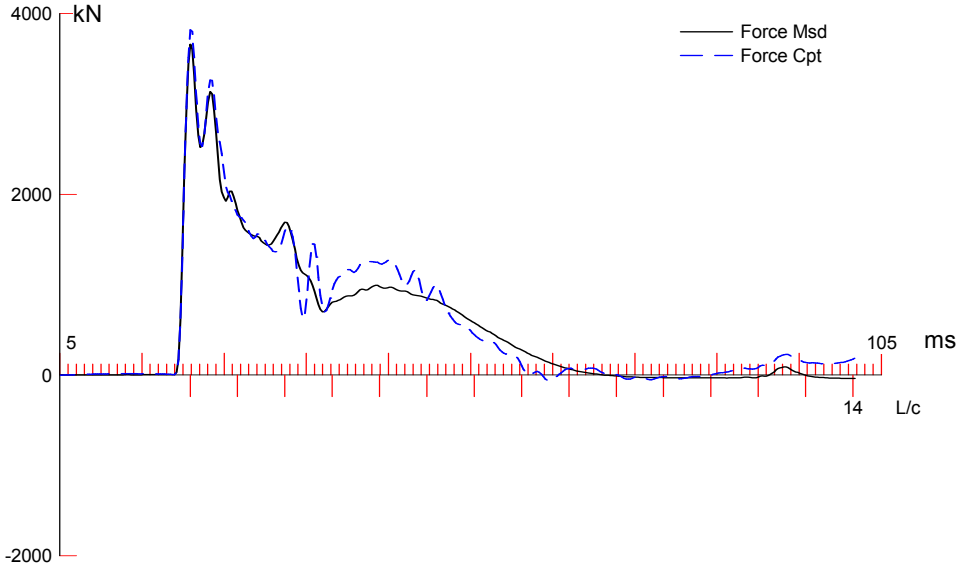
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	900.00	44969.5	25.000	1.200
24.20	900.00	44969.5	25.000	1.200

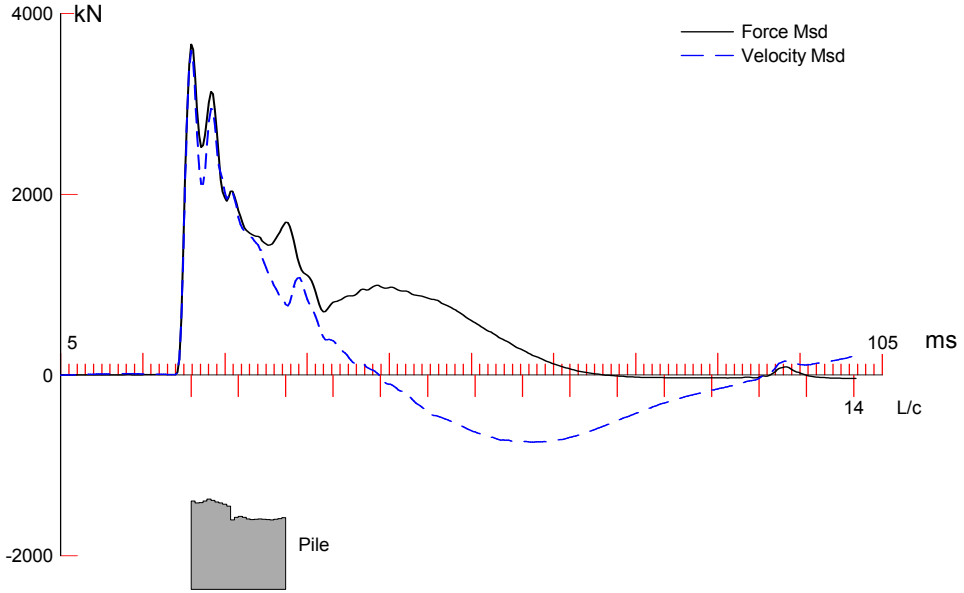
Koepaalutus Tuuliharju; Pile: TU-B2 24h — Test: 05-Mar-2015 10:17:
Junttan HHK 5A; Blow: 5 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

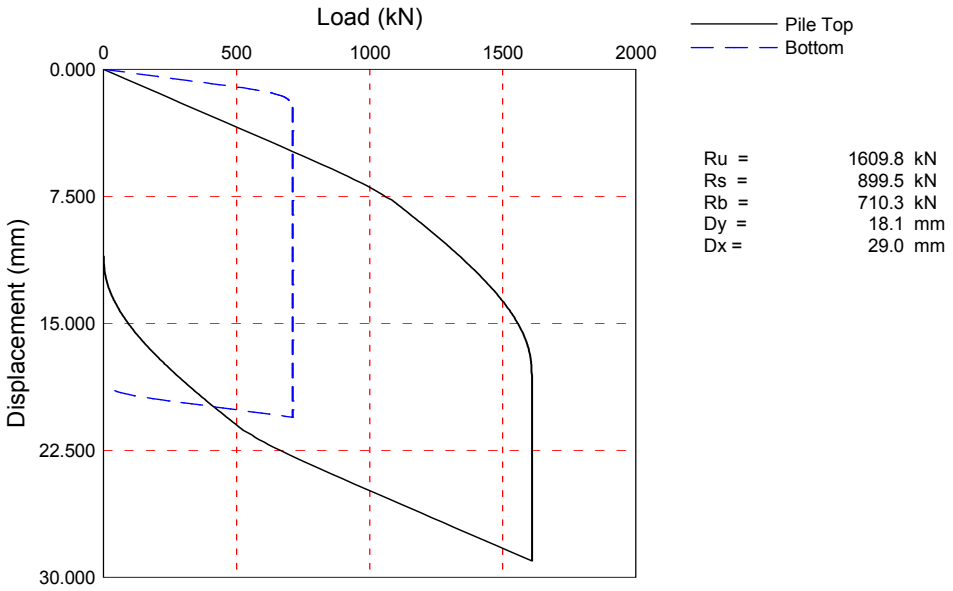
Toe Area 0.090 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.01	963.63	0.00	0.000	0.000	-0.000	0.000	1.200	0.00
2	2.02	872.93	-9.41	0.000	0.000	-0.000	0.000	1.200	0.51
3	3.02	861.33	-10.62	0.000	0.000	-0.000	0.000	1.200	0.52
4	4.03	901.53	-6.44	0.000	0.000	-0.000	0.000	1.200	0.52
5	5.04	910.23	-5.54	0.000	0.000	-0.000	0.000	1.200	0.52
6	6.05	852.23	-11.56	0.000	0.000	-0.000	0.000	1.200	0.52
7	7.06	837.03	-13.14	0.000	0.000	-0.000	0.000	1.200	0.52
8	8.07	843.63	-12.45	0.000	0.000	-0.000	0.000	1.200	0.52
9	9.07	722.13	-25.06	0.000	0.000	-0.000	0.000	1.200	0.52
10	10.08	725.43	-24.72	0.000	0.000	-0.000	0.000	1.200	0.52
11	11.09	732.73	-23.96	0.000	0.000	-0.000	0.000	1.200	0.52
12	12.10	733.13	-23.92	0.000	0.000	-0.000	0.000	1.200	0.52
13	13.11	727.73	-24.48	0.000	0.000	-0.000	0.000	1.200	0.52
14	14.12	739.43	-23.27	0.000	0.000	-0.000	0.000	1.200	0.52
15	15.12	743.33	-22.86	0.000	0.000	-0.000	0.000	1.200	0.52
16	16.13	740.93	-23.11	0.000	0.000	-0.000	0.000	1.200	0.52
17	17.14	740.23	-23.18	0.000	0.000	-0.000	0.000	1.200	0.52
18	18.15	741.03	-23.10	0.000	0.000	-0.000	0.000	1.200	0.52
19	19.16	741.43	-23.06	0.000	0.000	-0.000	0.000	1.200	0.52
20	20.17	748.63	-22.31	0.000	0.000	-0.000	0.000	1.200	0.52
21	21.17	754.23	-21.73	0.000	0.000	-0.000	0.000	1.200	0.52
22	22.18	756.53	-21.49	0.000	0.000	-0.000	0.000	1.200	0.52
23	23.19	758.13	-21.33	0.000	0.000	-0.000	0.000	1.200	0.52
24	24.20	761.93	-20.93	0.000	0.000	-0.000	0.000	1.200	0.52

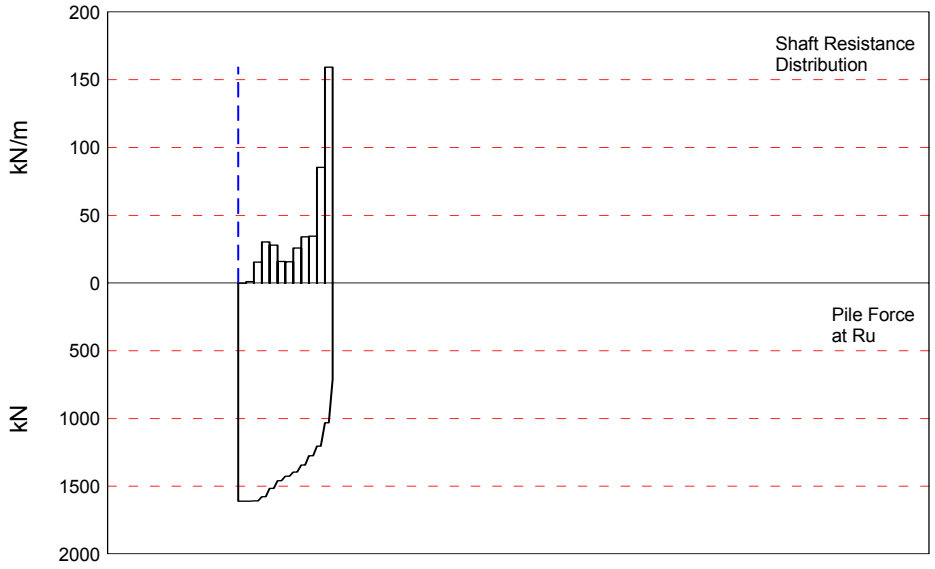
Pile Damping 2.0 %, Time Incr 0.240 ms, Wave Speed 4200.0 m/s, 2L/c 11.5 ms







Ru	=	1609.8 kN
Rs	=	899.5 kN
Rb	=	710.3 kN
Dy	=	18.1 mm
Dx	=	29.0 mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Zatelliitin koepaalutus 14vrk; Pile: TU-B2 14 vrk Test: 18-Mar-2015 15:19:
Junttan HHK 7A; Blow: 5 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1609.8; along Shaft 899.5; at Toe 710.3 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				1609.8				
1	2.0	2.0	0.0	1609.8	0.0	0.00	0.00	0.000
2	4.0	4.0	2.4	1607.4	2.4	1.19	0.99	0.348
3	6.0	6.1	31.0	1576.4	33.4	15.37	12.81	0.348
4	8.1	8.1	61.0	1515.4	94.4	30.25	25.21	0.348
5	10.1	10.1	56.6	1458.8	151.0	28.07	23.39	0.348
6	12.1	12.1	32.0	1426.8	183.0	15.87	13.22	0.348
7	14.1	14.1	31.9	1394.9	214.9	15.82	13.18	0.348
8	16.1	16.1	52.1	1342.8	267.0	25.83	21.53	0.348
9	18.1	18.1	69.1	1273.7	336.1	34.26	28.55	0.348
10	20.2	20.2	69.8	1203.9	405.9	34.61	28.84	0.348
11	22.2	22.2	172.4	1031.5	578.3	85.49	71.24	0.348
12	24.2	24.2	321.2	710.3	899.5	159.27	132.73	0.348
Avg. Shaft			75.0			37.17	30.97	0.348
Toe			710.3				7892.22	0.478

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	7.324	1.481
Case Damping Factor		0.325	0.352
Damping Type			Smith
Unloading Quake	(% of loading quake)	99	122
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	7	
Resistance Gap (included in Toe Quake)	(mm)		0.177
Soil Plug Weight	(kN)		3.35
Soil Support Dashpot		0.000	3.136
Soil Support Weight	(kN)	0.00	12.10

CAPWAP match quality = 3.48 (Force Match) ; RSA = 0
Observed: final set = 11.000 mm; blow count = 91 b/m
Computed: final set = 18.096 mm; blow count = 55 b/m

max. Top Comp. Stress = 42.5 MPa (T= 21.1 ms, max= 1.028 x Top)
max. Comp. Stress = 43.7 MPa (Z= 3.0 m, T= 21.8 ms)
max. Tens. Stress = -1.33 MPa (Z= 18.1 m, T= 79.2 ms)
max. Energy (EMX) = 65.55 kJ; max. Measured Top Displ. (DMX)=30.47 mm

Zatelliitin koepaalutus 14vrk; Pile: TU-B2 14 vrk — Test: 18-Mar-2015 15:19:
Junttan HHK 7A; Blow: 5 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3821.1	-65.9	42.5	-0.73	65.55	3.6	30.150
2	2.0	3927.2	-58.8	43.6	-0.65	65.72	3.6	29.819
4	4.0	3915.7	-81.7	43.5	-0.91	65.24	3.6	29.144
6	6.0	3915.8	-105.5	43.5	-1.17	64.62	3.6	28.463
7	7.1	3860.4	-102.0	42.9	-1.13	63.02	3.6	28.144
8	8.1	3788.9	-105.2	42.1	-1.17	62.80	3.7	27.822
9	9.1	3574.0	-96.0	39.7	-1.07	59.96	3.8	27.502
10	10.1	3521.9	-108.6	39.1	-1.21	59.73	3.8	27.170
11	11.1	3463.4	-109.2	38.5	-1.21	57.06	3.8	26.782
12	12.1	3478.1	-118.2	38.6	-1.31	56.80	3.8	26.409
13	13.1	3422.1	-116.6	38.0	-1.30	55.28	3.8	26.080
14	14.1	3423.4	-118.1	38.0	-1.31	55.06	3.8	25.739
15	15.1	3378.0	-112.7	37.5	-1.25	53.55	3.7	25.383
16	16.1	3383.0	-117.8	37.6	-1.31	53.29	3.7	25.003
17	17.1	3335.5	-114.8	37.1	-1.28	51.06	3.7	24.638
18	18.1	3370.3	-119.7	37.4	-1.33	50.84	3.7	24.298
19	19.2	3286.7	-106.9	36.5	-1.19	48.14	3.6	24.019
20	20.2	3326.6	-104.4	37.0	-1.16	47.99	3.6	23.722
21	21.2	3280.4	-97.4	36.4	-1.08	45.29	3.5	23.466
22	22.2	3405.3	-114.4	37.8	-1.27	45.14	3.3	23.221
23	23.2	3020.4	-77.8	33.6	-0.86	39.08	3.6	23.024
24	24.2	2778.1	-89.5	30.9	-0.99	27.63	3.9	22.842
Absolute	3.0			43.7			(T =	21.8 ms)
	18.1				-1.33		(T =	79.2 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3754.3	3396.7	3039.1	2681.5	2323.9	1966.3	1608.7	1251.1	893.5	535.8
RX	3754.3	3396.7	3039.1	2681.5	2323.9	1966.3	1608.7	1316.2	1269.3	1258.6
RU	3754.3	3396.7	3039.1	2681.5	2323.9	1966.3	1608.7	1251.1	893.5	535.8

RAU = 1241.2 (kN); RA2 = 1747.0 (kN)

Current CAPWAP Ru = 1609.8 (kN); Corresponding J(RP)= 0.60; J(RX) = 0.60

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
3.77	21.13	3628.5	3701.8	3701.8	30.465	11.011	11.000	64.4	3108.6

PILE PROFILE AND PILE MODEL

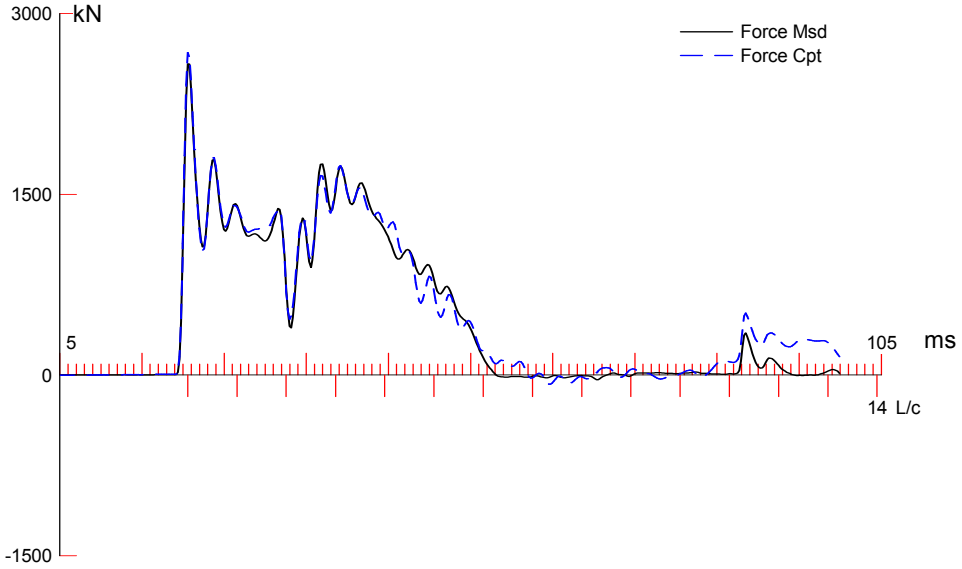
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	900.00	44969.5	25.000	1.200
24.20	900.00	44969.5	25.000	1.200

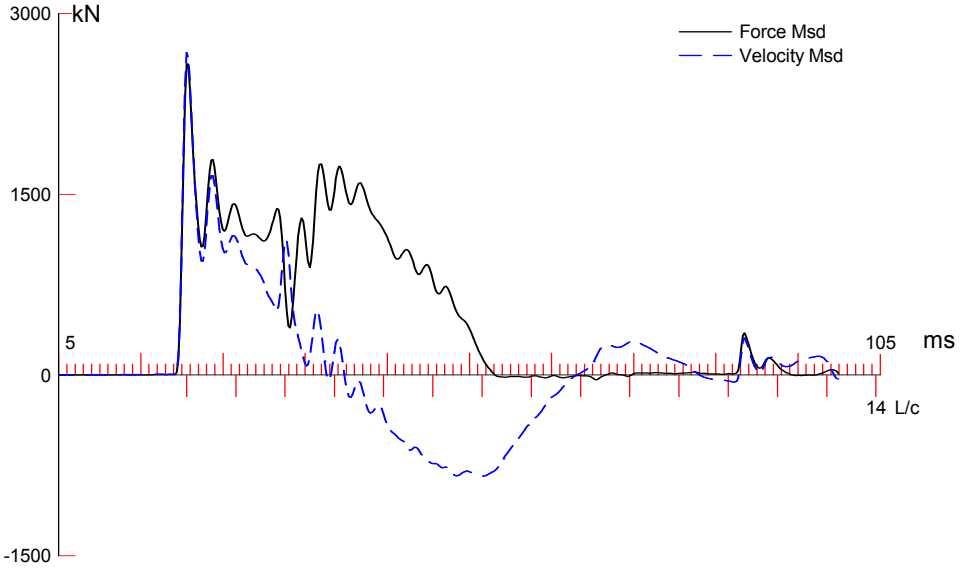
Zatelliitin koepaalutus 14vrk; Pile: TU-B2 14 vrk Test: 18-Mar-2015 15:19:
Junttan HHK 7A; Blow: 5 CAPWAP(R) 2006-2
Inspecta OP: TRe

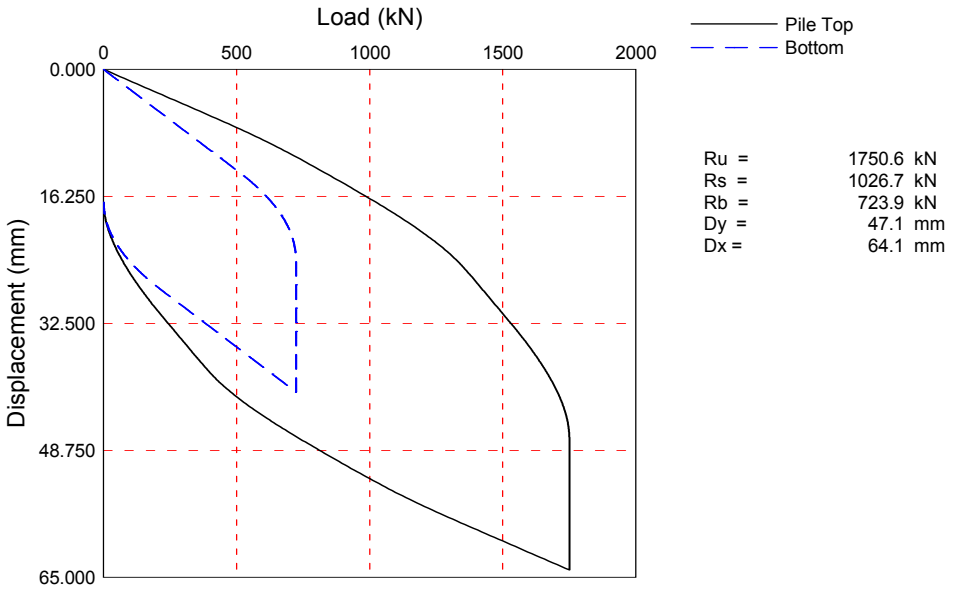
Toe Area 0.090 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.01	963.63	0.00	0.000	0.000	-0.000	0.000	1.200	0.00
2	2.02	944.03	-2.03	0.000	0.000	-0.000	0.000	1.200	0.34
3	3.02	945.43	-1.89	0.000	0.000	-0.000	0.000	1.200	0.32
4	4.03	964.33	0.07	0.000	0.000	-0.000	0.000	1.200	0.32
5	5.04	984.83	2.20	0.000	0.000	-0.000	0.000	1.200	0.32
6	6.05	973.43	1.02	0.000	0.000	-0.000	0.000	1.200	0.32
7	7.06	954.33	-0.97	0.000	0.000	-0.000	0.000	1.200	0.32
8	8.07	942.33	-2.21	0.000	0.000	-0.000	0.000	1.200	0.32
9	9.07	928.63	-3.63	0.000	0.000	-0.000	0.000	1.200	0.32
10	10.08	909.13	-5.66	0.000	0.000	-0.000	0.000	1.200	0.32
11	11.09	758.93	-21.24	0.000	0.000	-0.000	0.000	1.200	0.32
12	12.10	787.63	-18.26	0.000	0.000	-0.000	0.000	1.200	0.32
13	13.11	795.93	-17.40	0.000	0.000	-0.000	0.000	1.200	0.32
14	14.12	785.03	-18.53	0.000	0.000	-0.000	0.000	1.200	0.32
15	15.12	768.23	-20.28	0.000	0.000	-0.000	0.000	1.200	0.32
16	16.13	760.33	-21.10	0.000	0.000	-0.000	0.000	1.200	0.32
17	17.14	765.13	-20.60	0.000	0.000	-0.000	0.000	1.200	0.32
18	18.15	769.63	-20.13	0.000	0.000	-0.000	0.000	1.200	0.32
19	19.16	764.43	-20.67	0.000	0.000	-0.000	0.000	1.200	0.32
20	20.17	761.03	-21.02	0.000	0.000	-0.000	0.000	1.200	0.32
21	21.17	759.43	-21.19	0.000	0.000	-0.000	0.000	1.200	0.32
22	22.18	764.03	-20.71	0.000	0.000	-0.000	0.000	1.200	0.32
23	23.19	773.03	-19.78	0.000	0.000	-0.000	0.000	1.200	0.32
24	24.20	781.93	-18.86	0.000	0.000	-0.000	0.000	1.200	0.32

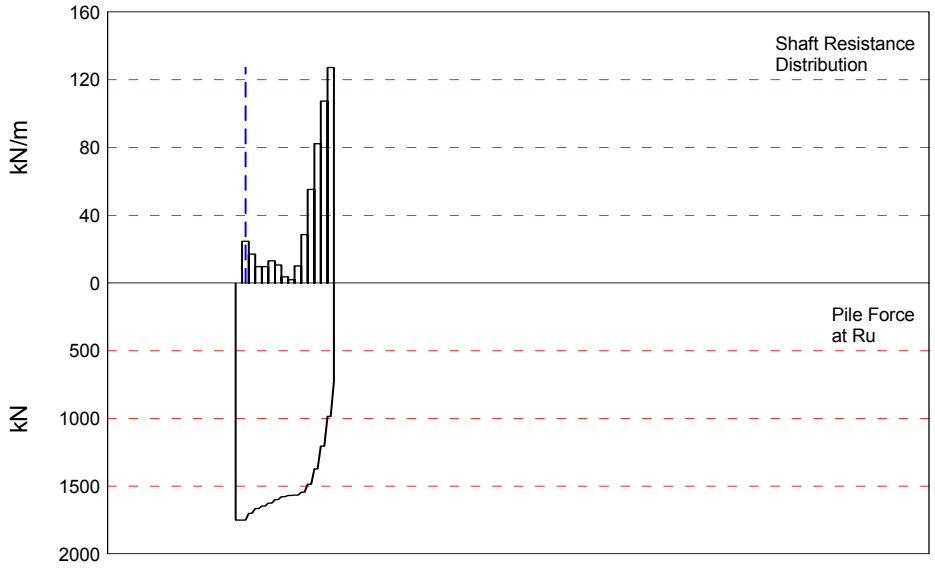
Pile Damping 2.0 %, Time Incr 0.240 ms, Wave Speed 4200.0 m/s, 2L/c 11.5 ms







Ru = 1750.6 kN
Rs = 1026.7 kN
Rb = 723.9 kN
Dy = 47.1 mm
Dx = 64.1 mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Koepaalutus Tuuliharju; Pile: TU-T1 0h — Test: 04-Mar-2015 09:23:
Junttan HHK 5A; Blow: 828 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1750.6; along Shaft 1026.7; at Toe 723.9 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				1750.6				
1	4.1	0.4	50.4	1700.2	50.4	128.14	125.92	0.143
2	6.1	2.4	35.0	1665.2	85.4	17.10	16.81	0.143
3	8.2	4.5	20.1	1645.1	105.5	9.82	9.65	0.143
4	10.2	6.5	20.1	1625.0	125.6	9.82	9.65	0.143
5	12.3	8.6	26.8	1598.2	152.4	13.09	12.87	0.143
6	14.3	10.6	21.8	1576.4	174.2	10.65	10.47	0.143
7	16.4	12.7	7.6	1568.8	181.8	3.71	3.65	0.143
8	18.4	14.7	4.1	1564.7	185.9	2.00	1.97	0.143
9	20.5	16.8	20.7	1544.0	206.6	10.11	9.94	0.143
10	22.5	18.8	58.4	1485.6	265.0	28.53	28.04	0.143
11	24.6	20.9	113.0	1372.6	378.0	55.21	54.26	0.143
12	26.6	22.9	168.5	1204.1	546.5	82.33	80.91	0.143
13	28.7	25.0	219.9	984.2	766.4	107.44	105.59	0.143
14	30.7	27.0	260.3	723.9	1026.7	127.18	124.99	0.143
Avg. Shaft			73.3			38.03	37.37	0.143
Toe			723.9				8785.50	0.160

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	7.044	18.676
Case Damping Factor		0.363	0.286
Unloading Quake	(% of loading quake)	127	149
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	32	
Resistance Gap (included in Toe Quake)	(mm)		8.488
Soil Plug Weight	(kN)		0.25
Soil Support Dashpot		8.300	10.000
Soil Support Weight	(kN)	10.41	10.41

CAPWAP match quality = 1.95 (Force Match) ; RSA = 0
Observed: final set = 17.000 mm; blow count = 59 b/m
Computed: final set = 9.902 mm; blow count = 101 b/m

max. Top Comp. Stress = 271.5 MPa (T= 20.8 ms, max= 1.010 x Top)
max. Comp. Stress = 274.1 MPa (Z= 4.1 m, T= 21.6 ms)
max. Tens. Stress = -26.57 MPa (Z= 22.5 m, T= 62.7 ms)
max. Energy (EMX) = 61.37 kJ; max. Measured Top Displ. (DMX)=42.41 mm

Koepaalutus Tuuliharju; Pile: TU-T1 0h — Test: 04-Mar-2015 09:23:
Junttan HHK 5A; Blow: 828 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2677.1	-77.3	271.5	-7.84	61.37	6.6	41.608
2	2.0	2678.8	-89.6	271.6	-9.09	61.20	6.6	40.806
4	4.1	2703.5	-109.9	274.1	-11.14	59.90	6.5	39.208
6	6.1	2654.8	-133.8	269.2	-13.56	56.05	6.4	37.650
8	8.2	2618.2	-133.7	265.5	-13.56	53.08	6.4	36.098
10	10.2	2600.8	-146.6	263.7	-14.87	50.93	6.4	34.573
12	12.3	2586.0	-175.7	262.2	-17.82	48.94	6.3	33.121
14	14.3	2560.0	-169.7	259.6	-17.21	46.62	6.3	31.858
16	16.4	2532.9	-195.5	256.8	-19.82	44.85	6.2	30.590
18	18.4	2523.5	-209.8	255.9	-21.27	43.56	6.2	29.204
19	19.4	2525.4	-218.8	256.1	-22.19	42.89	6.2	28.492
20	20.5	2538.5	-224.7	257.4	-22.79	42.37	6.2	27.781
21	21.5	2529.4	-242.0	256.5	-24.54	41.13	6.1	27.084
22	22.5	2557.4	-262.0	259.3	-26.57	40.63	6.0	26.384
23	23.5	2515.0	-246.1	255.0	-24.96	38.19	6.0	25.709
24	24.6	2559.9	-246.8	259.6	-25.03	37.71	5.9	25.026
25	25.6	2465.2	-195.1	250.0	-19.78	33.74	5.8	24.385
26	26.6	2523.7	-204.6	255.9	-20.75	33.32	5.6	23.741
27	27.6	2361.1	-160.2	239.4	-16.24	28.18	5.5	23.181
28	28.7	2330.2	-165.5	236.3	-16.78	27.96	5.8	22.627
29	29.7	1756.0	-93.6	178.1	-9.49	21.80	7.0	22.196
30	30.7	1316.7	-95.0	133.5	-9.63	14.41	7.6	21.756
Absolute	4.1			274.1			(T =	21.6 ms)
	22.5				-26.57		(T =	62.7 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	2444.9	2155.5	1866.2	1576.9	1287.5	998.2	708.9	419.6	130.2	0.0
RX	2444.9	2155.5	1866.2	1798.8	1751.1	1740.4	1735.4	1730.5	1725.5	1720.5
RU	2444.9	2155.5	1866.2	1576.9	1287.5	998.2	708.9	419.6	130.2	0.0

RAU = 1523.5 (kN); RA2 = 1831.9 (kN)

Current CAPWAP Ru = 1750.6 (kN); Corresponding J(RP)= 0.24; J(RX) = 0.40

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
6.72	20.78	2716.5	2621.6	2634.9	42.407	16.721	17.000	61.5	2069.3

Koepaalutus Tuuliharju; Pile: TU-T1 0h — Test: 04-Mar-2015 09:23:
Junttan HHK 5A; Blow: 828 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

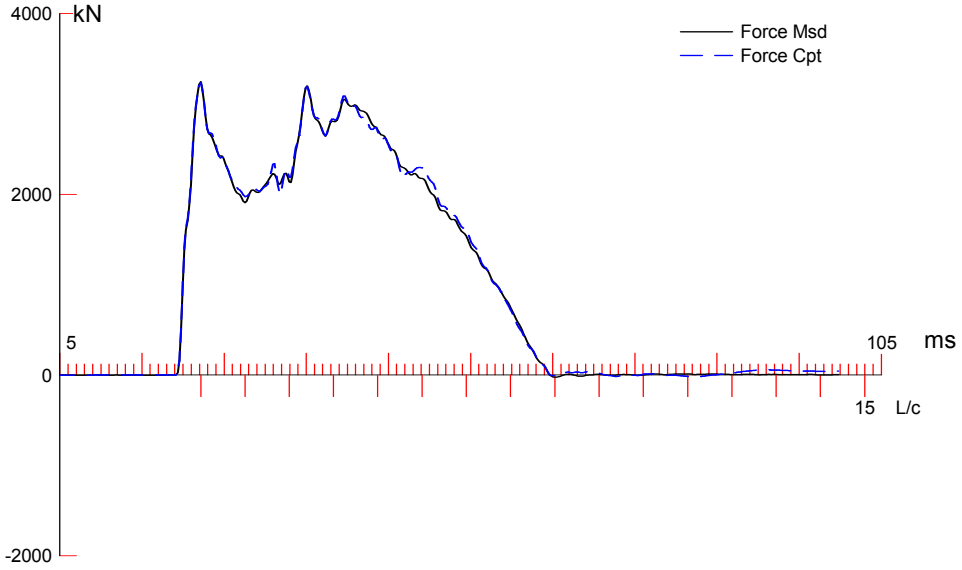
PILE PROFILE AND PILE MODEL

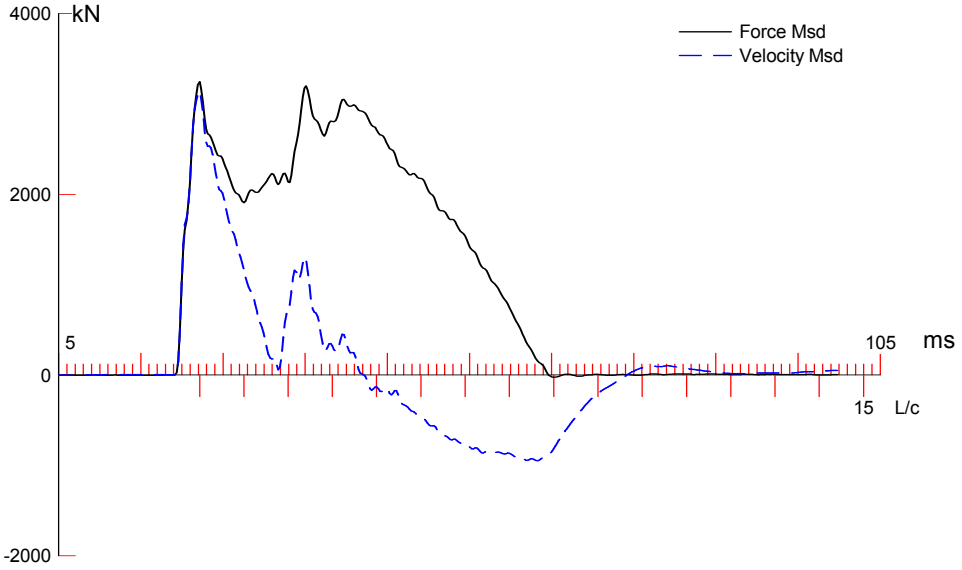
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
30.70	98.61	210000.0	78.500	1.018

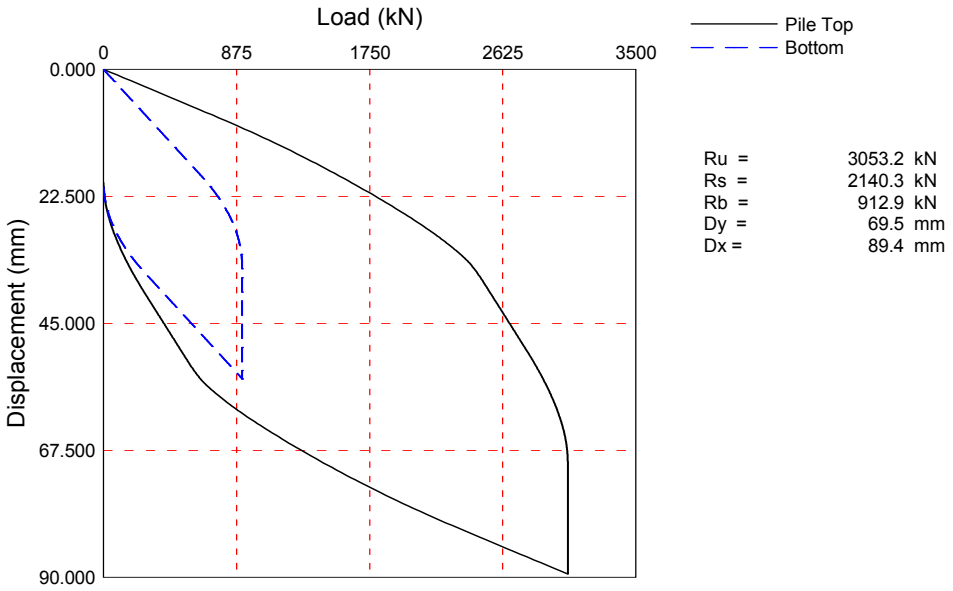
Toe Area 0.082 m^2

Top Segment Length 1.02 m, Top Impedance 404.32 kN/m/s

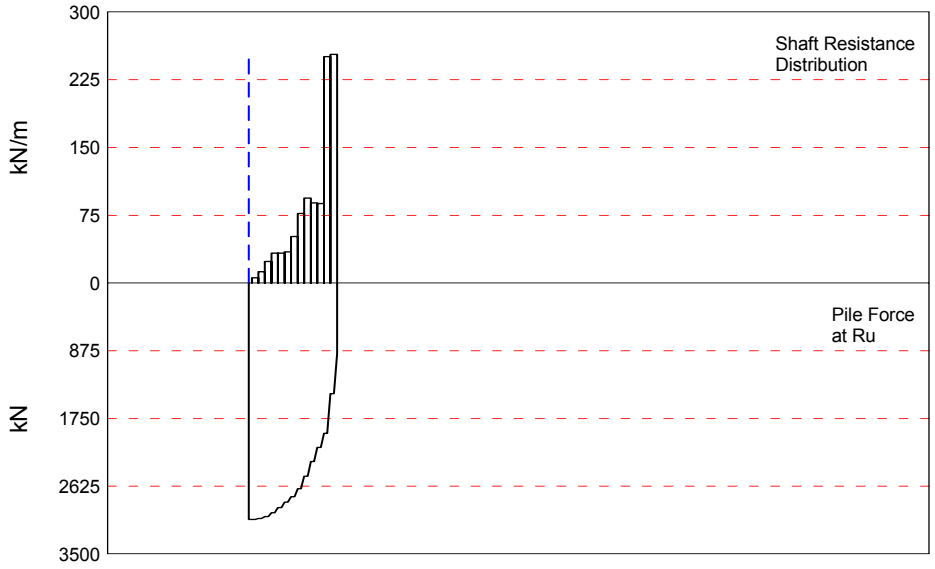
Pile Damping 1.0 %, Time Incr 0.200 ms, Wave Speed 5121.9 m/s, 2L/c 12.0 ms







Ru	=	3053.2 kN
Rs	=	2140.3 kN
Rb	=	912.9 kN
Dy	=	69.5 mm
Dx	=	89.4 mm



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Tuuliharjun koepaalutus; Pile: TU-T1 Test: 31-Mar-2015 09:01:
Vapaapudotusjarkale 9t; Blow: 24 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 3053.2; along Shaft 2140.3; at Toe 912.9 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				3053.2				
1	3.1	3.1	11.8	3041.4	11.8	3.85	3.78	0.153
2	5.1	5.1	25.6	3015.8	37.4	12.52	12.31	0.153
3	7.2	7.2	49.3	2966.5	86.7	24.11	23.70	0.153
4	9.2	9.2	67.8	2898.7	154.5	33.16	32.59	0.153
5	11.2	11.2	67.7	2831.0	222.2	33.11	32.54	0.153
6	13.3	13.3	70.6	2760.4	292.8	34.53	33.94	0.153
7	15.3	15.3	105.5	2654.9	398.3	51.60	50.71	0.153
8	17.4	17.4	157.9	2497.0	556.2	77.23	75.90	0.153
9	19.4	19.4	192.6	2304.4	748.8	94.21	92.58	0.153
10	21.5	21.5	181.8	2122.6	930.6	88.92	87.39	0.153
11	23.5	23.5	179.7	1942.9	1110.3	87.90	86.38	0.153
12	25.6	25.6	512.6	1430.3	1622.9	250.73	246.40	0.153
13	27.6	27.6	517.4	912.9	2140.3	253.08	248.71	0.153
Avg. Shaft			164.6			77.55	76.21	0.153
Toe			912.9				11079.27	0.088

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	7.499	26.779
Case Damping Factor		0.810	0.199
Unloading Quake	(% of loading quake)	145	50
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	10	
Resistance Gap (included in Toe Quake)	(mm)		5.889
Soil Plug Weight	(kN)		2.14
Soil Support Dashpot		4.000	0.000
Soil Support Weight	(kN)	10.40	0.00

CAPWAP match quality = 1.83 (Wave Up Match) ; RSA = 0
Observed: final set = 20.000 mm; blow count = 50 b/m
Computed: final set = 15.036 mm; blow count = 67 b/m

max. Top Comp. Stress = 329.7 MPa (T= 35.5 ms, max= 1.057 x Top)
max. Comp. Stress = 348.5 MPa (Z= 7.2 m, T= 36.7 ms)
max. Tens. Stress = -27.53 MPa (Z= 19.4 m, T= 69.1 ms)
max. Energy (EMX) = 147.60 kJ; max. Measured Top Displ. (DMX)=60.10 mm

Tuuliharjun koepaalutus; Pile: TU-T1 Test: 31-Mar-2015 09:01:
Vapaapudotusjarkale 9t; Blow: 24 CAPWAP(R) 2006-2
Inspecta OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3251.1	-32.1	329.7	-3.25	147.60	7.8	58.186
2	2.0	3304.4	-60.6	335.1	-6.15	145.59	7.7	56.773
4	4.1	3346.9	-94.2	339.4	-9.55	140.61	7.6	53.981
6	6.1	3398.9	-136.4	344.7	-13.83	134.84	7.5	51.284
8	8.2	3398.5	-159.9	344.6	-16.22	128.16	7.3	48.868
10	10.2	3379.0	-179.1	342.6	-18.16	120.35	7.1	46.417
12	12.3	3302.0	-214.2	334.8	-21.72	112.93	6.9	43.985
13	13.3	3313.1	-235.4	336.0	-23.87	111.39	6.7	42.751
14	14.3	3245.6	-236.4	329.1	-23.97	105.61	6.6	41.531
15	15.3	3255.3	-261.3	330.1	-26.50	104.00	6.4	40.274
16	16.4	3134.6	-252.5	317.9	-25.61	96.61	6.2	39.034
17	17.4	3155.3	-267.9	320.0	-27.17	95.01	6.0	37.780
18	18.4	2955.7	-249.9	299.7	-25.34	85.62	5.8	36.585
19	19.4	3033.4	-271.5	307.6	-27.53	84.16	5.6	35.387
20	20.4	2827.3	-235.6	286.7	-23.89	74.12	5.3	34.290
21	21.5	3051.4	-244.4	309.4	-24.78	72.90	5.0	33.194
22	22.5	2846.8	-221.8	288.7	-22.50	64.33	4.6	32.268
23	23.5	2774.5	-236.7	281.4	-24.00	63.43	4.9	31.329
24	24.5	2390.8	-203.8	242.4	-20.67	55.59	5.0	30.477
25	25.6	2340.2	-222.0	237.3	-22.51	54.86	4.9	29.626
26	26.6	1739.2	-126.7	176.4	-12.85	36.61	5.3	28.970
27	27.6	1715.0	-130.8	173.9	-13.26	18.00	5.4	28.300
Absolute	7.2			348.5			(T =	36.7 ms)
	19.4				-27.53		(T =	69.1 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	2891.8	2805.6	2719.5	2633.4	2547.3	2461.1	2375.0	2288.9	2202.8	2116.6
RX	3931.1	3686.3	3441.4	3316.6	3227.1	3137.7	3049.8	2965.1	2901.9	2881.6
RU	2891.8	2805.6	2719.5	2633.4	2547.3	2461.1	2375.0	2288.9	2202.8	2116.6

RAU = 2663.6 (kN); RA2 = 2921.6 (kN)

Current CAPWAP Ru = 3053.2 (kN); Corresponding J(RP)= 0.00; J(RX) = 0.60

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
7.80	22.35	1871.3	1881.7	3265.7	60.099	20.000	20.000	149.9	3742.0

PILE PROFILE AND PILE MODEL

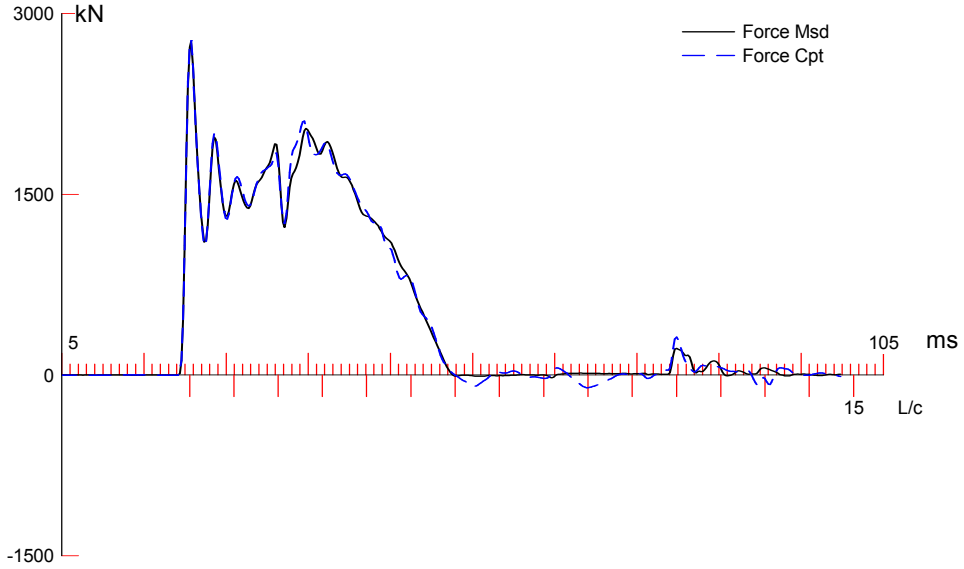
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
27.60	98.61	210000.0	78.500	1.018

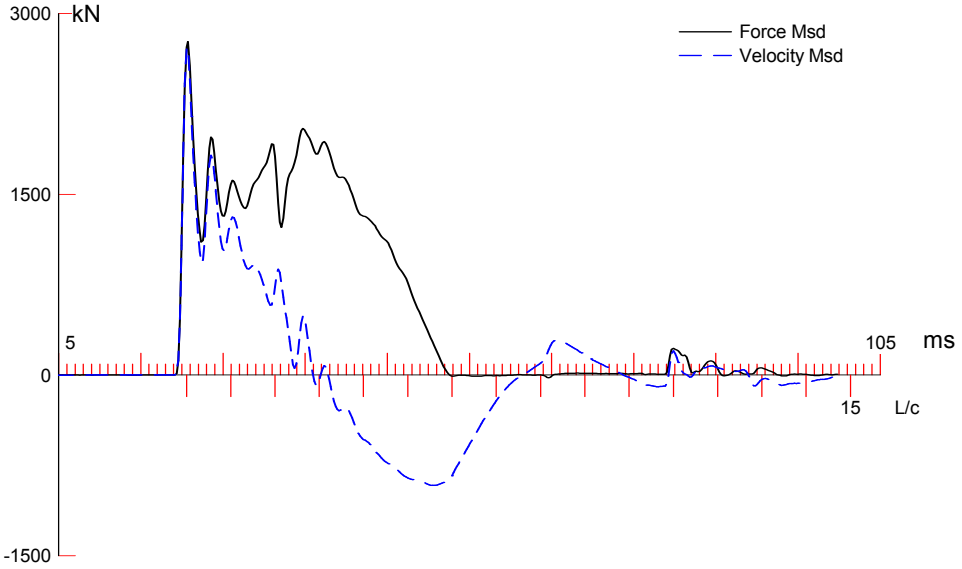
Tuuliharjun koepaalutus; Pile: TU-T1 Test: 31-Mar-2015 09:01:
Vapaapudotusjarkale 9t; Blow: 24 CAPWAP(R) 2006-2
Inspecta OP: TRe

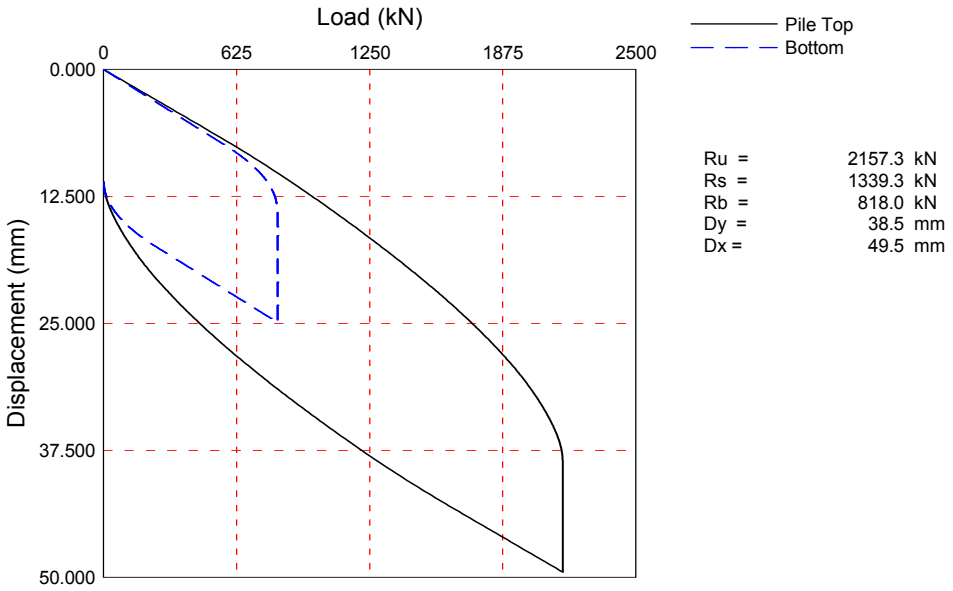
Toe Area 0.082 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.02	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.04	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02
3	3.07	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02
27	27.60	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02

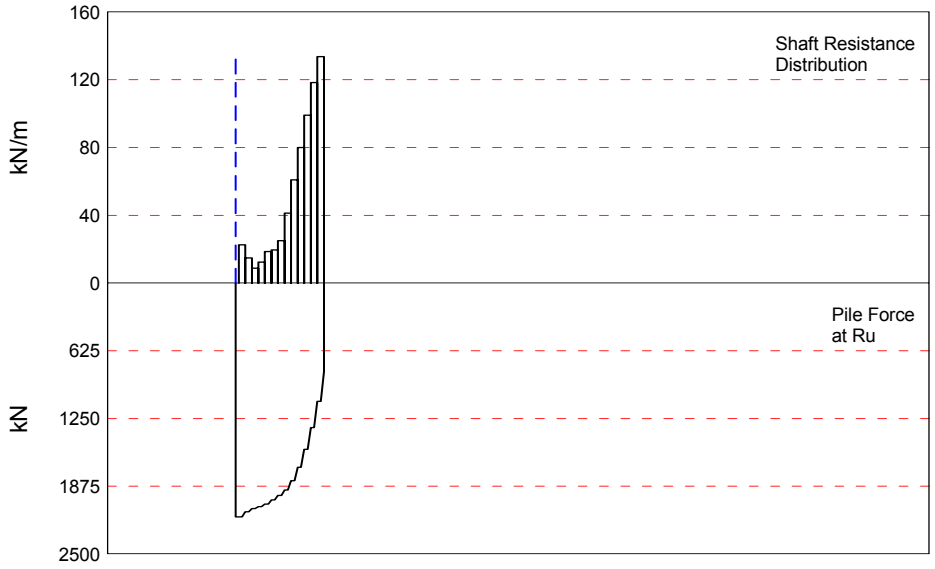
Pile Damping 1.0 %, Time Incr 0.200 ms, Wave Speed 5121.9 m/s, 2L/c 10.8 ms







Ru = 2157.3 kN
Rs = 1339.3 kN
Rb = 818.0 kN
Dy = 38.5 mm
Dx = 49.5 mm



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Koepaalutus Tuuliharju; Pile: TU-T1 24h — Test: 05-Mar-2015 11:02:
Junttan HHK 5A; Blow: 9 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2157.3; along Shaft 1339.3; at Toe 818.0 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				2157.3				
1	3.1	2.5	46.1	2111.2	46.1	18.69	18.37	0.116
2	5.1	4.5	30.2	2081.0	76.3	14.77	14.52	0.116
3	7.2	6.6	18.0	2063.0	94.3	8.80	8.65	0.116
4	9.2	8.6	25.5	2037.5	119.8	12.47	12.26	0.116
5	11.2	10.6	37.9	1999.6	157.7	18.54	18.22	0.116
6	13.3	12.7	40.2	1959.4	197.9	19.66	19.32	0.116
7	15.3	14.7	51.4	1908.0	249.3	25.14	24.71	0.116
8	17.4	16.8	84.5	1823.5	333.8	41.33	40.62	0.116
9	19.4	18.8	124.5	1699.0	458.3	60.90	59.85	0.116
10	21.5	20.9	163.4	1535.6	621.7	79.92	78.54	0.116
11	23.5	22.9	202.5	1333.1	824.2	99.05	97.34	0.116
12	25.6	25.0	241.8	1091.3	1066.0	118.27	116.23	0.116
13	27.6	27.0	273.3	818.0	1339.3	133.68	131.37	0.116
Avg. Shaft			103.0			49.60	48.75	0.116
Toe			818.0				9927.27	0.245

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	7.032	10.691
Case Damping Factor		0.384	0.495
Unloading Quake	(% of loading quake)	154	41
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	49	
Resistance Gap (included in Toe Quake)	(mm)		0.022
Soil Plug Weight	(kN)		0.50
Soil Support Dashpot		2.886	3.588
Soil Support Weight	(kN)	10.40	10.40

CAPWAP match quality = 1.61 (Force Match) ; RSA = 0
Observed: final set = 11.000 mm; blow count = 91 b/m
Computed: final set = 11.033 mm; blow count = 91 b/m

max. Top Comp. Stress = 281.5 MPa (T= 21.0 ms, max= 1.017 x Top)
max. Comp. Stress = 286.2 MPa (Z= 3.1 m, T= 21.6 ms)
max. Tens. Stress = -23.33 MPa (Z= 15.3 m, T= 58.3 ms)
max. Energy (EMX) = 68.34 kJ; max. Measured Top Displ. (DMX)=39.99 mm

Koepaalutus Tuuliharju; Pile: TU-T1 24h — Test: 05-Mar-2015 11:02:
Junttan HHK 5A; Blow: 9 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2775.7	-105.1	281.5	-10.66	68.34	6.6	39.059
2	2.0	2803.9	-134.6	284.3	-13.65	67.99	6.6	38.127
4	4.1	2777.2	-138.3	281.6	-14.02	64.01	6.6	36.239
6	6.1	2759.5	-149.0	279.8	-15.11	61.08	6.6	34.476
8	8.2	2754.7	-168.7	279.3	-17.11	58.61	6.5	32.650
10	10.2	2744.9	-194.9	278.3	-19.76	55.85	6.5	30.795
12	12.3	2722.2	-200.8	276.0	-20.36	52.89	6.4	29.036
13	13.3	2734.3	-218.2	277.3	-22.13	52.10	6.4	28.164
14	14.3	2699.4	-210.1	273.7	-21.30	50.00	6.4	27.305
15	15.3	2714.6	-230.0	275.3	-23.33	49.22	6.3	26.438
16	16.4	2674.3	-216.7	271.2	-21.97	46.89	6.3	25.598
17	17.4	2697.8	-229.7	273.6	-23.29	46.19	6.2	24.774
18	18.4	2631.6	-206.6	266.9	-20.95	43.18	6.1	23.988
19	19.4	2663.9	-223.0	270.1	-22.61	42.50	6.0	23.175
20	20.4	2566.7	-202.7	260.3	-20.55	38.81	5.9	22.491
21	21.5	2606.6	-217.9	264.3	-22.09	38.36	5.8	21.837
22	22.5	2483.3	-196.2	251.8	-19.89	34.10	5.7	21.230
23	23.5	2529.8	-202.3	256.5	-20.52	33.66	5.5	20.598
24	24.5	2382.4	-181.9	241.6	-18.44	29.04	5.4	20.049
25	25.6	2458.8	-185.8	249.3	-18.84	28.74	5.2	19.521
26	26.6	2147.4	-176.6	217.8	-17.91	24.37	5.8	19.164
27	27.6	1791.1	-180.6	181.6	-18.32	19.99	6.5	18.814
Absolute	3.1			286.2			(T =	21.6 ms)
	15.3				-23.33		(T =	58.3 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3281.3	3053.6	2825.8	2598.1	2370.4	2142.7	1914.9	1687.2	1459.5	1231.8
RX	3281.3	3053.6	2825.8	2598.1	2370.4	2205.4	2104.2	2052.4	2004.9	1960.7
RU	3281.3	3053.6	2825.8	2598.1	2370.4	2142.7	1914.9	1687.2	1459.5	1231.8

RAU = 1833.7 (kN); RA2 = 2100.9 (kN)

Current CAPWAP Ru = 2157.3 (kN); Corresponding J(RP)= 0.49; J(RX) = 0.55

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
6.85	20.76	2769.3	2789.2	2817.1	39.989	10.998	11.000	69.5	2725.5

PILE PROFILE AND PILE MODEL

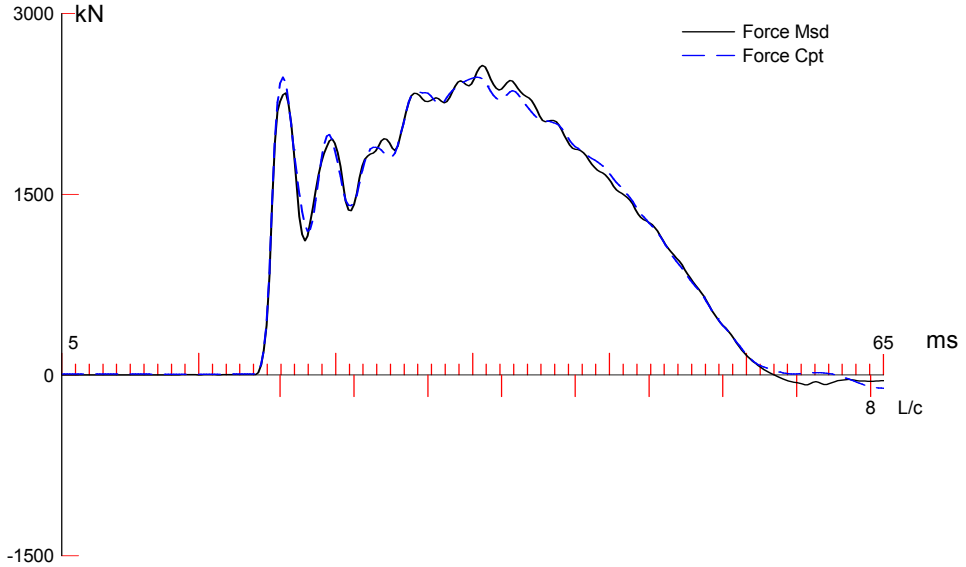
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
27.60	98.61	210000.0	78.500	1.018

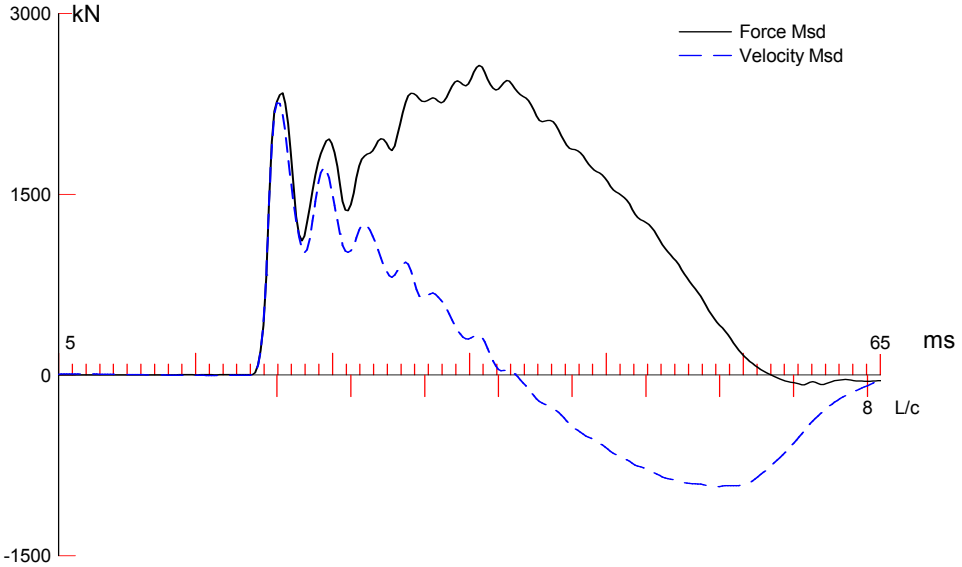
Koepaalutus Tuuliharju; Pile: TU-T1 24h — Test: 05-Mar-2015 11:02:
Junttan HHK 5A; Blow: 9 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

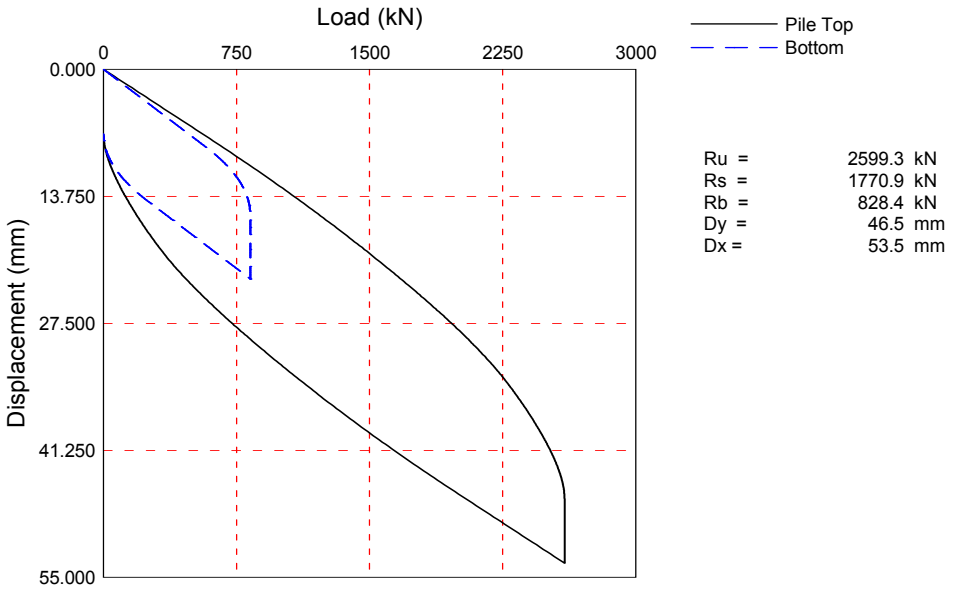
Toe Area 0.082 m^2

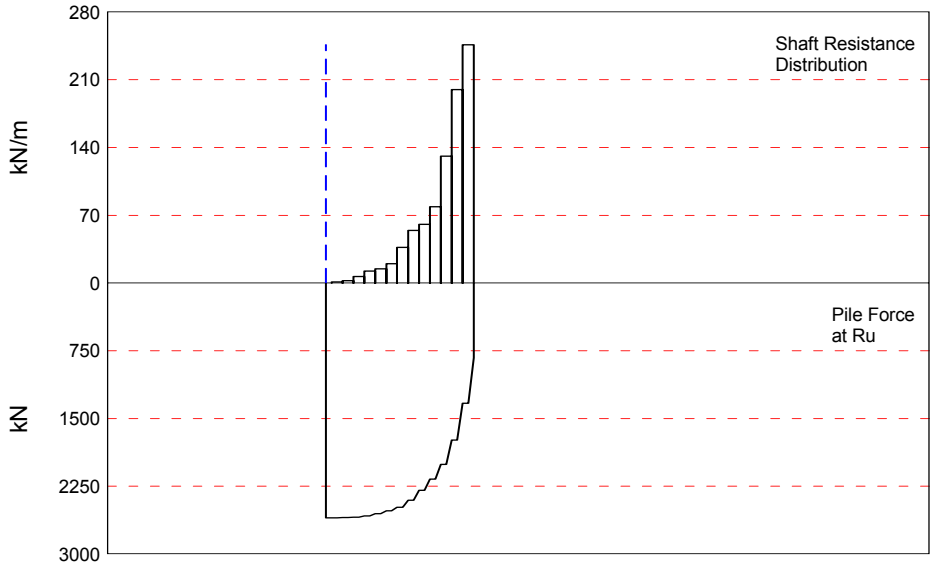
Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.02	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.04	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.04
3	3.07	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.03
27	27.60	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.03

Pile Damping 1.0 %, Time Incr 0.200 ms, Wave Speed 5121.9 m/s, 2L/c 10.8 ms









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Zatelliitin koepaalutus 14vrk; Pile: TU-T1 14 vrk Test: 18-Mar-2015 14:33:
Junttan HHK 7A; Blow: 9 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2599.3; along Shaft 1770.9; at Toe 828.4 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				2599.3				
1	3.1	3.1	2.4	2596.9	2.4	0.78	0.77	0.378
2	5.1	5.1	5.1	2591.8	7.5	2.49	2.45	0.378
3	7.2	7.2	14.0	2577.8	21.5	6.85	6.73	0.378
4	9.2	9.2	25.2	2552.6	46.7	12.33	12.11	0.378
5	11.2	11.2	30.3	2522.3	77.0	14.82	14.56	0.378
6	13.3	13.3	41.3	2481.0	118.3	20.20	19.85	0.378
7	15.3	15.3	75.8	2405.2	194.1	37.08	36.44	0.378
8	17.4	17.4	111.0	2294.2	305.1	54.29	53.36	0.378
9	19.4	19.4	124.5	2169.7	429.6	60.90	59.85	0.378
10	21.5	21.5	161.2	2008.5	590.8	78.85	77.49	0.378
11	23.5	23.5	268.1	1740.4	858.9	131.14	128.87	0.378
12	25.6	25.6	408.5	1331.9	1267.4	199.81	196.36	0.378
13	27.6	27.6	503.5	828.4	1770.9	246.28	242.03	0.378
Avg. Shaft			136.2			64.16	63.06	0.378
Toe			828.4				10053.75	0.158

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	6.444	12.076
Case Damping Factor		1.655	0.324
Unloading Quake	(% of loading quake)	94	80
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	25	
Resistance Gap (included in Toe Quake)	(mm)		1.015
Soil Support Dashpot		3.800	0.000
Soil Support Weight	(kN)	10.40	0.00

CAPWAP match quality = 1.49 (Force Match) ; RSA = 0
Observed: final set = 7.000 mm; blow count = 143 b/m
Computed: final set = 5.379 mm; blow count = 186 b/m

max. Top Comp. Stress = 250.7 MPa (T= 35.5 ms, max= 1.076 x Top)
max. Comp. Stress = 269.7 MPa (Z= 9.2 m, T= 32.7 ms)
max. Tens. Stress = -30.47 MPa (Z= 15.3 m, T= 61.3 ms)
max. Energy (EMX) = 78.02 kJ; max. Measured Top Displ. (DMX)=41.73 mm

Zatelliitin koepaalutus 14vrk; Pile: TU-T1 14 vrk — Test: 18-Mar-2015 14:33:
Junttan HHK 7A; Blow: 9 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2472.3	-110.8	250.7	-11.24	78.02	5.5	40.581
2	2.0	2492.9	-133.0	252.8	-13.49	77.02	5.5	39.433
4	4.1	2541.8	-152.3	257.8	-15.44	74.05	5.5	37.123
6	6.1	2566.7	-165.3	260.3	-16.76	70.80	5.5	34.773
8	8.2	2607.1	-195.2	264.4	-19.80	67.02	5.4	32.428
10	10.2	2650.6	-229.9	268.8	-23.31	62.67	5.3	30.082
12	12.3	2588.4	-260.2	262.5	-26.39	58.27	5.2	27.764
13	13.3	2582.7	-282.9	261.9	-28.69	56.90	5.1	26.621
14	14.3	2551.3	-281.6	258.7	-28.56	53.64	5.0	25.495
15	15.3	2593.3	-300.5	263.0	-30.47	52.30	4.9	24.363
16	16.4	2528.1	-279.8	256.4	-28.38	48.00	4.8	23.265
17	17.4	2550.0	-298.0	258.6	-30.22	46.73	4.6	22.165
18	18.4	2407.9	-264.1	244.2	-26.78	41.78	4.5	21.115
19	19.4	2403.5	-279.5	243.7	-28.34	40.63	4.3	20.070
20	20.4	2242.8	-236.4	227.4	-23.97	35.97	4.1	19.103
21	21.5	2253.6	-248.4	228.5	-25.18	35.01	3.9	18.150
22	22.5	2080.2	-192.3	210.9	-19.50	30.23	3.7	17.271
23	23.5	2146.1	-204.5	217.6	-20.73	29.41	3.4	16.390
24	24.5	1828.5	-112.0	185.4	-11.36	23.60	3.2	15.613
25	25.6	1834.4	-120.6	186.0	-12.23	22.99	3.2	14.848
26	26.6	1412.8	-5.2	143.3	-0.53	16.21	3.4	14.232
27	27.6	1414.8	-6.7	143.5	-0.68	8.38	3.3	13.617
Absolute	9.2			269.7			(T =	32.7 ms)
	15.3				-30.47		(T =	61.3 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3084.9	2938.6	2792.2	2645.9	2499.6	2353.3	2206.9	2060.6	1914.3	1768.0
RX	3117.1	2967.4	2817.6	2710.8	2640.4	2592.7	2549.8	2506.8	2466.4	2434.0
RU	3084.9	2938.6	2792.2	2645.9	2499.6	2353.3	2206.9	2060.6	1914.3	1768.0

RAU = 644.2 (kN); RA2 = 2029.5 (kN)

Current CAPWAP Ru = 2599.3 (kN); Corresponding J(RP)= 0.33; J(RX) = 0.49

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
5.63	21.16	2276.5	2271.6	2575.5	41.725	7.106	7.000	79.2	3251.8

PILE PROFILE AND PILE MODEL

Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
27.60	98.61	210000.0	78.500	1.018

Zatelliitin koepaalutus 14vrk; Pile: TU-T1 14 vrk Test: 18-Mar-2015 14:33:
Junttan HHK 7A; Blow: 9 CAPWAP(R) 2006-2
Inspecta OP: TRe

Toe Area 0.082 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.02	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.04	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.09
27	27.60	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.09

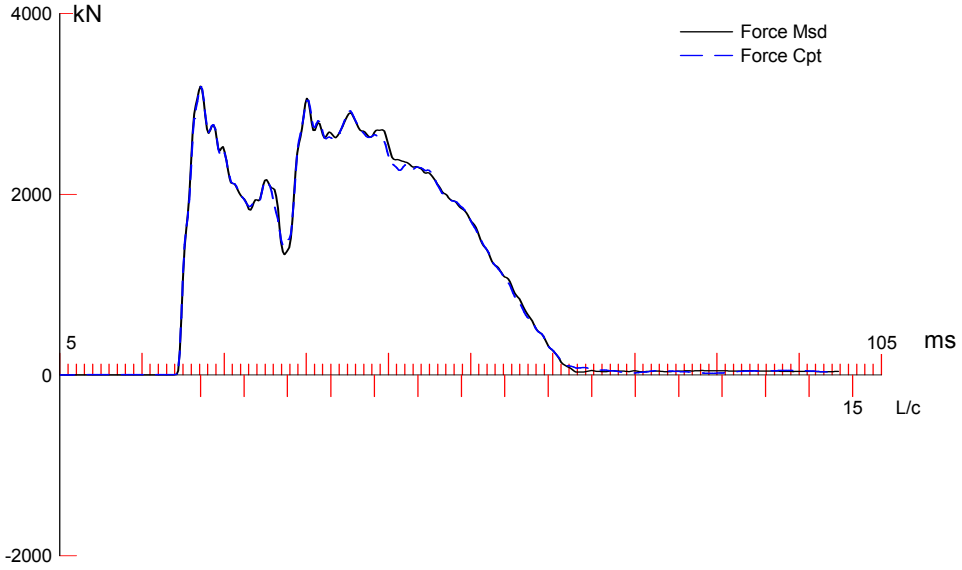
Pile Damping 1.0 %, Time Incr 0.200 ms, Wave Speed 5121.9 m/s, 2L/c 10.8 ms

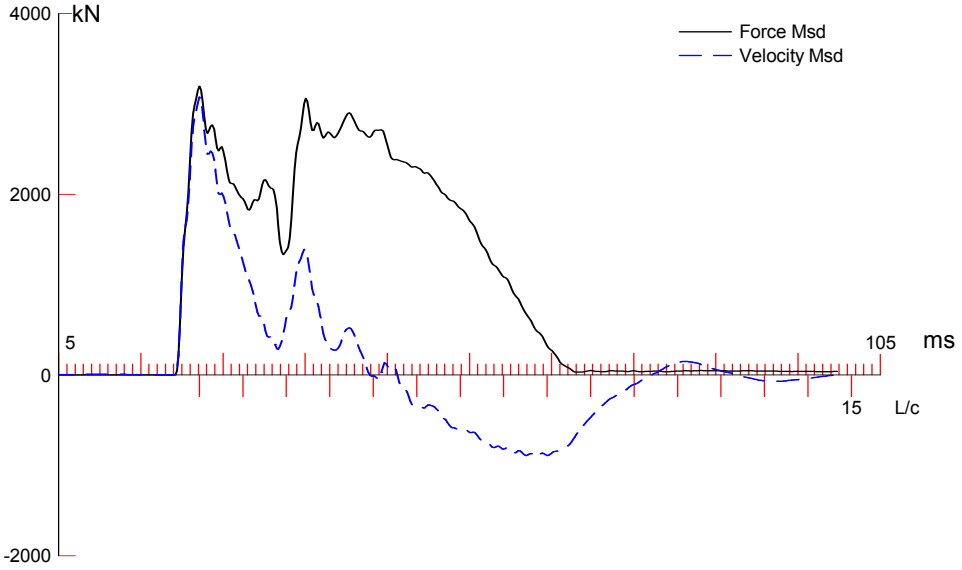
Tuuliharjun koepaalutus; Pile: TU-T2; Vapaapudotusjarkale 9t; Blow: 7 (Test: 31-Mar-2015 09:43:)

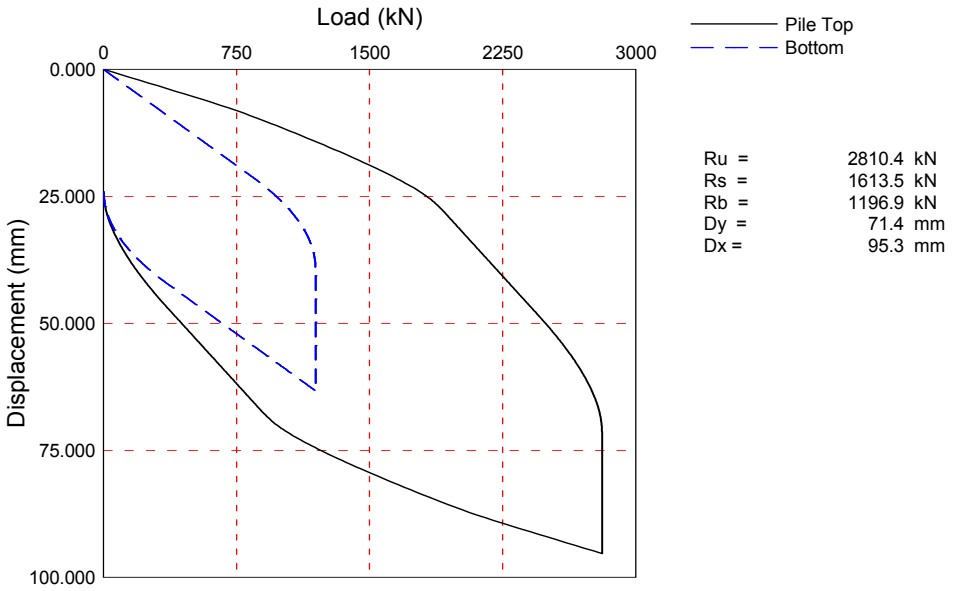
Inspecta

01-Apr-2015

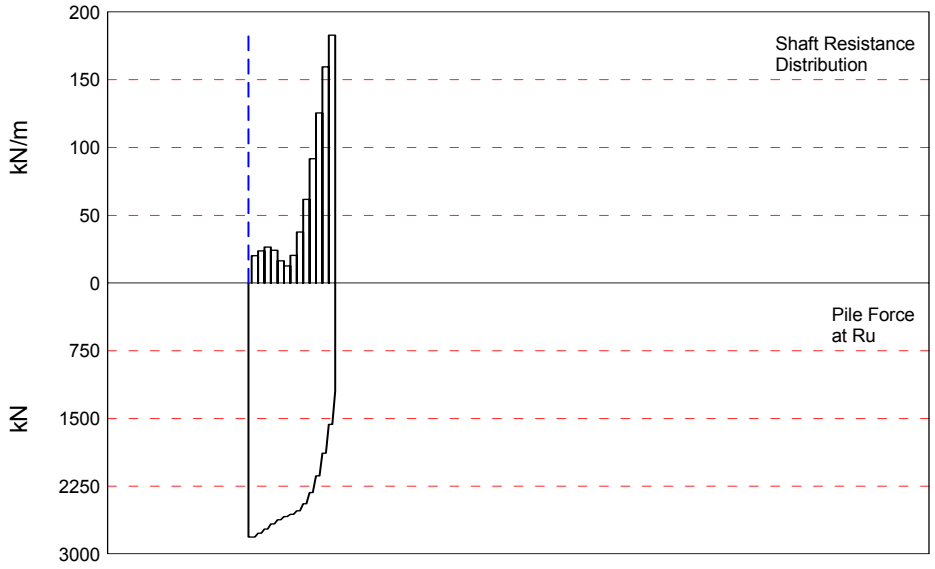
CAPWAP(R) 2006-2







Ru	=	2810.4 kN
Rs	=	1613.5 kN
Rb	=	1196.9 kN
Dy	=	71.4 mm
Dx	=	95.3 mm



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Tuuliharjun koepaalutus; Pile: TU-T2 Test: 31-Mar-2015 09:43:
Vapaapudotusjarkale 9t; Blow: 7 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2810.4; along Shaft 1613.5; at Toe 1196.9 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				2810.4				
1	3.0	3.0	40.5	2769.9	40.5	13.45	13.22	0.179
2	5.0	5.0	47.9	2722.0	88.4	23.86	23.45	0.179
3	7.0	7.0	53.5	2668.5	141.9	26.65	26.19	0.179
4	9.0	9.0	48.6	2619.9	190.5	24.21	23.79	0.179
5	11.0	11.0	33.2	2586.7	223.7	16.54	16.25	0.179
6	13.0	13.0	25.4	2561.3	249.1	12.65	12.43	0.179
7	15.1	15.1	41.2	2520.1	290.3	20.52	20.17	0.179
8	17.1	17.1	75.6	2444.5	365.9	37.66	37.01	0.179
9	19.1	19.1	123.9	2320.6	489.8	61.72	60.66	0.179
10	21.1	21.1	184.4	2136.2	674.2	91.86	90.27	0.179
11	23.1	23.1	252.0	1884.2	926.2	125.54	123.37	0.179
12	25.1	25.1	320.2	1564.0	1246.4	159.51	156.76	0.179
13	27.1	27.1	367.1	1196.9	1613.5	182.87	179.72	0.179
Avg. Shaft			124.1			59.54	58.51	0.179
Toe			1196.9				14526.00	0.075

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	5.714	30.215
Case Damping Factor		0.714	0.222
Unloading Quake	(% of loading quake)	140	77
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	14	
Resistance Gap (included in Toe Quake)	(mm)		9.764
Soil Plug Weight	(kN)		0.67
Soil Support Dashpot		4.338	10.000
Soil Support Weight	(kN)	10.21	10.21

CAPWAP match quality = 1.70 (Wave Up Match) ; RSA = 0
Observed: final set = 24.000 mm; blow count = 42 b/m
Computed: final set = 19.468 mm; blow count = 51 b/m

max. Top Comp. Stress = 326.0 MPa (T= 22.5 ms, max= 1.017 x Top)
max. Comp. Stress = 331.6 MPa (Z= 3.0 m, T= 22.9 ms)
max. Tens. Stress = -17.80 MPa (Z= 19.1 m, T= 71.3 ms)
max. Energy (EMX) = 158.14 kJ; max. Measured Top Displ. (DMX)=64.13 mm

Tuuliharjun koepaalutus; Pile: TU-T2 Test: 31-Mar-2015 09:43:
Vapaapudotusjarkale 9t; Blow: 7 CAPWAP(R) 2006-2
Inspecta OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3215.3	-0.9	326.0	-0.09	158.14	7.6	63.794
2	2.0	3239.9	-7.3	328.5	-0.74	156.74	7.5	62.628
4	4.0	3200.8	-15.2	324.6	-1.54	149.77	7.4	60.261
6	6.0	3188.6	-41.1	323.3	-4.16	142.31	7.2	57.897
8	8.0	3167.5	-63.6	321.2	-6.45	134.50	7.1	55.505
10	10.0	3150.5	-84.4	319.5	-8.56	127.26	7.0	53.073
12	12.0	3114.5	-107.5	315.8	-10.90	121.51	6.9	50.652
13	13.0	3135.4	-122.2	317.9	-12.39	120.03	6.8	49.451
14	14.1	3085.1	-136.2	312.8	-13.81	116.67	6.7	48.293
15	15.1	3076.4	-154.4	312.0	-15.66	115.39	6.6	47.174
16	16.1	3038.9	-150.9	308.2	-15.31	111.16	6.4	46.085
17	17.1	3118.4	-168.6	316.2	-17.10	109.92	6.2	44.989
18	18.1	3051.8	-163.4	309.5	-16.57	103.58	6.0	43.911
19	19.1	3159.3	-175.6	320.4	-17.80	102.35	5.7	42.821
20	20.1	3033.2	-144.2	307.6	-14.62	93.38	5.5	41.773
21	21.1	3087.3	-147.8	313.1	-14.99	92.23	5.2	40.713
22	22.1	2668.8	-107.2	270.6	-10.87	80.38	5.6	39.725
23	23.1	2626.4	-116.2	266.3	-11.78	79.36	5.8	38.728
24	24.1	2232.2	-52.5	226.4	-5.33	64.67	5.7	37.856
25	25.1	2142.1	-63.8	217.2	-6.47	63.92	5.8	36.999
26	26.1	1723.3	-20.7	174.8	-2.09	46.71	5.9	36.300
27	27.1	1716.9	-30.4	174.1	-3.09	27.76	6.0	35.617
Absolute	3.0			331.6			(T =	22.9 ms)
	19.1				-17.80		(T =	71.3 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3512.1	3233.7	2955.2	2676.7	2398.2	2119.7	1841.2	1562.7	1284.2	1005.8
RX	3512.1	3273.4	3166.0	3059.6	2955.2	2851.0	2804.4	2772.8	2755.6	2751.3
RU	3512.1	3233.7	2955.2	2676.7	2398.2	2119.7	1841.2	1562.7	1284.2	1005.8

RAU = 2441.9 (kN); RA2 = 2849.8 (kN)

Current CAPWAP Ru = 2810.4 (kN); Corresponding J(RP)= 0.25; J(RX) = 0.59

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
7.65	22.34	3092.2	3204.8	3204.8	64.130	24.232	24.000	157.6	3576.9

Tuuliharjun koepaalutus; Pile: TU-T2 Test: 31-Mar-2015 09:43:
Vapaapudotusjarkale 9t; Blow: 7 CAPWAP(R) 2006-2
Inspecta OP: TRe

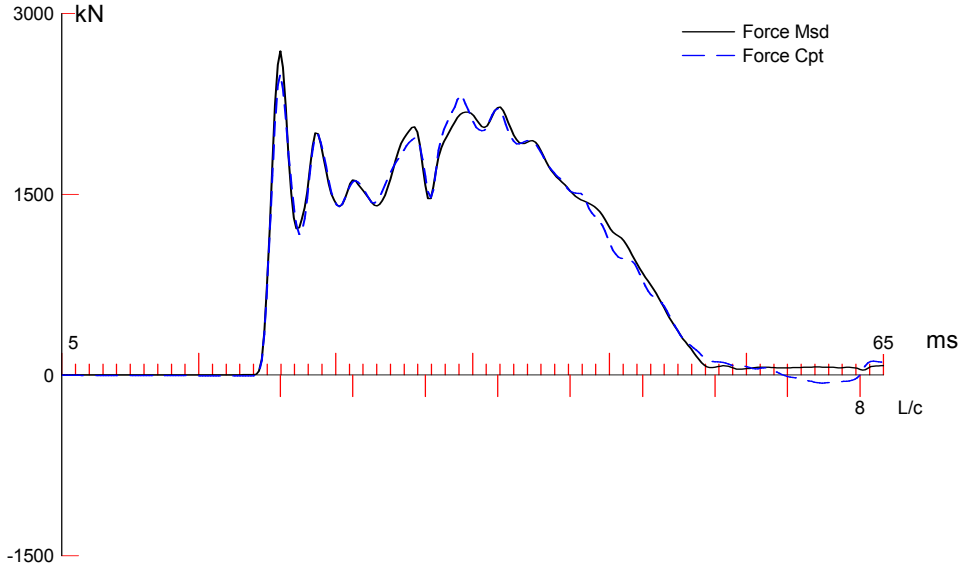
PILE PROFILE AND PILE MODEL

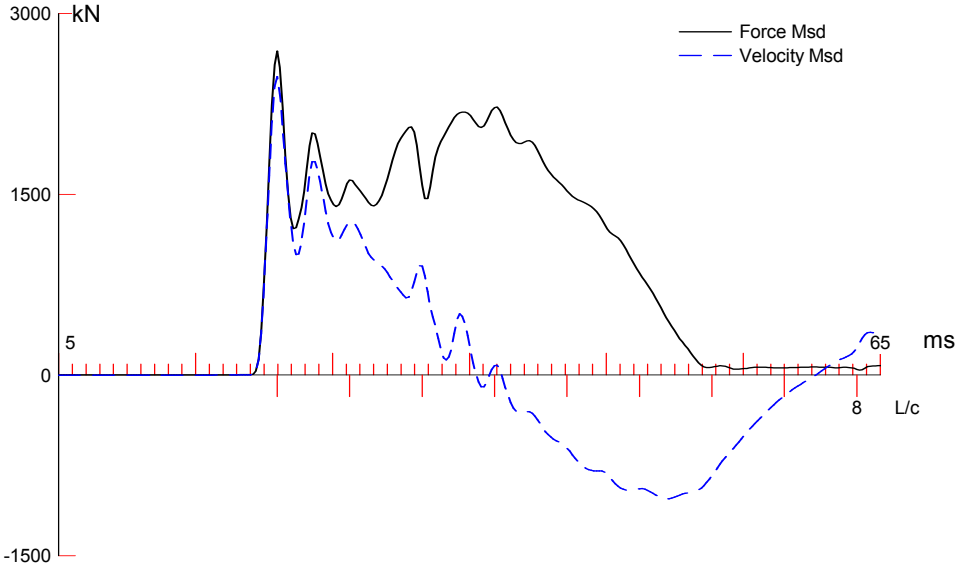
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
27.10	98.61	210000.0	78.500	1.018

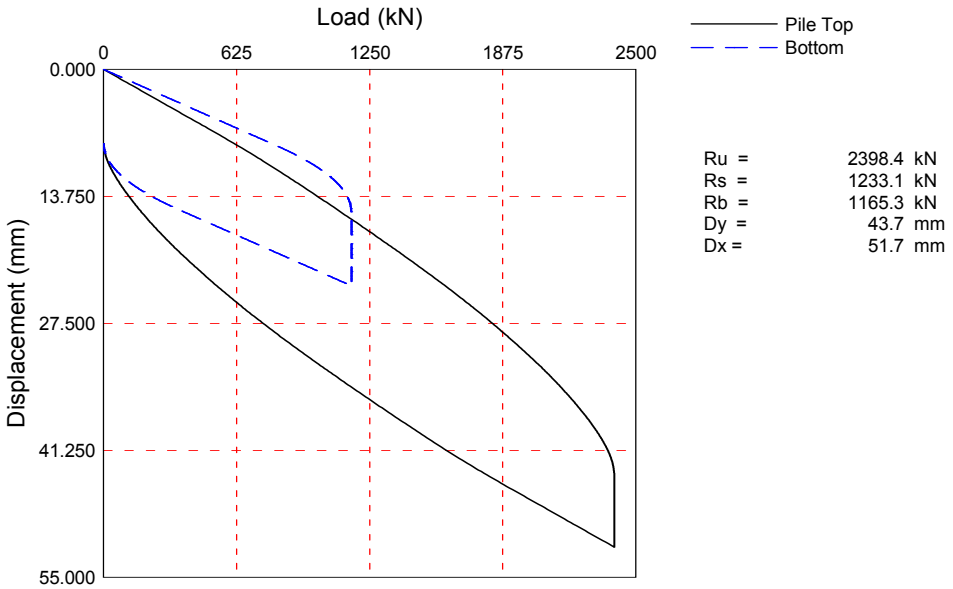
Toe Area 0.082 m^2

Top Segment Length 1.00 m, Top Impedance 404.32 kN/m/s

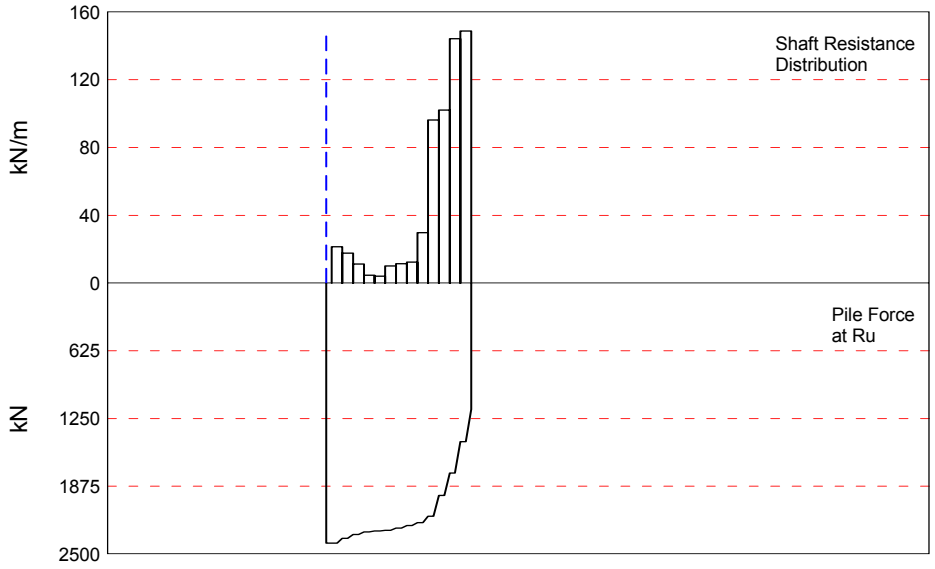
Pile Damping 1.0 %, Time Incr 0.196 ms, Wave Speed 5121.9 m/s, 2L/c 10.6 ms







Ru = 2398.4 kN
Rs = 1233.1 kN
Rb = 1165.3 kN
Dy = 43.7 mm
Dx = 51.7 mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Koepaalutus Tuuliharju; Pile: TU-T2 24h — Test: 05-Mar-2015 10:54:
Junttan HHK 5A; Blow: 7 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2398.4; along Shaft 1233.1; at Toe 1165.3 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				2398.4				
1	3.0	3.0	43.0	2355.4	43.0	14.28	14.03	0.336
2	5.0	5.0	35.6	2319.8	78.6	17.73	17.43	0.336
3	7.0	7.0	22.8	2297.0	101.4	11.36	11.16	0.336
4	9.0	9.0	9.5	2287.5	110.9	4.73	4.65	0.336
5	11.0	11.0	8.1	2279.4	119.0	4.04	3.97	0.336
6	13.0	13.0	20.2	2259.2	139.2	10.06	9.89	0.336
7	15.1	15.1	23.1	2236.1	162.3	11.51	11.31	0.336
8	17.1	17.1	25.0	2211.1	187.3	12.45	12.24	0.336
9	19.1	19.1	59.7	2151.4	247.0	29.74	29.23	0.336
10	21.1	21.1	193.1	1958.3	440.1	96.19	94.53	0.336
11	23.1	23.1	204.9	1753.4	645.0	102.07	100.31	0.336
12	25.1	25.1	289.4	1464.0	934.4	144.17	141.68	0.336
13	27.1	27.1	298.7	1165.3	1233.1	148.80	146.23	0.336
Avg. Shaft			94.9			45.50	44.72	0.336
Toe			1165.3				14142.49	0.070

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	7.501	11.857
Case Damping Factor		1.025	0.200
Unloading Quake	(% of loading quake)	52	122
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	64	
Resistance Gap (included in Toe Quake)	(mm)		2.618
Soil Plug Weight	(kN)		0.47

CAPWAP match quality = 1.91 (Force Match) ; RSA = 0
Observed: final set = 8.000 mm; blow count = 125 b/m
Computed: final set = 7.000 mm; blow count = 143 b/m

max. Top Comp. Stress = 253.3 MPa (T= 21.2 ms, max= 1.026 x Top)
max. Comp. Stress = 260.0 MPa (Z= 3.0 m, T= 21.8 ms)
max. Tens. Stress = -23.04 MPa (Z= 19.1 m, T= 56.4 ms)
max. Energy (EMX) = 65.94 kJ; max. Measured Top Displ. (DMX)=38.83 mm

Koepaalutus Tuuliharju; Pile: TU-T2 24h — Test: 05-Mar-2015 10:54:
Junttan HHK 5A; Blow: 7 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2497.9	-67.1	253.3	-6.80	65.94	6.1	37.810
2	2.0	2539.8	-94.9	257.6	-9.63	65.16	6.0	36.769
4	4.0	2476.5	-95.0	251.1	-9.64	59.96	5.9	34.675
6	6.0	2418.3	-92.6	245.2	-9.39	55.60	5.8	32.657
8	8.0	2377.0	-96.2	241.0	-9.75	52.10	5.8	30.612
10	10.0	2383.5	-112.1	241.7	-11.37	49.29	5.8	28.504
12	12.0	2411.0	-135.9	244.5	-13.78	46.57	5.7	26.387
13	13.0	2411.0	-157.9	244.5	-16.01	45.44	5.7	25.340
14	14.1	2380.8	-163.5	241.4	-16.58	43.41	5.6	24.303
15	15.1	2377.3	-184.9	241.1	-18.75	42.30	5.6	23.264
16	16.1	2350.5	-183.7	238.4	-18.62	40.28	5.5	22.238
17	17.1	2353.4	-206.0	238.6	-20.89	39.20	5.5	21.219
18	18.1	2323.1	-206.2	235.6	-20.91	37.26	5.4	20.212
19	19.1	2385.0	-227.2	241.9	-23.04	36.17	5.2	19.185
20	20.1	2342.3	-193.1	237.5	-19.58	33.19	5.0	18.153
21	21.1	2436.7	-212.6	247.1	-21.56	32.05	4.8	17.102
22	22.1	2152.5	-71.3	218.3	-7.23	26.10	4.5	16.155
23	23.1	2255.4	-91.0	228.7	-9.23	25.18	4.3	15.211
24	24.1	1986.3	-3.0	201.4	-0.30	20.15	4.1	14.366
25	25.1	1978.3	-3.0	200.6	-0.31	19.50	4.1	13.570
26	26.1	1600.8	-1.6	162.3	-0.16	13.84	4.7	12.914
27	27.1	1563.6	-1.6	158.6	-0.17	8.30	5.1	12.235
Absolute	3.0			260.0			(T =	21.8 ms)
	19.1				-23.04		(T =	56.4 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	2948.8	2722.5	2496.3	2270.0	2043.7	1817.4	1591.1	1364.8	1138.6	912.3
RX	2948.8	2722.5	2536.0	2431.1	2369.6	2331.4	2303.4	2290.0	2276.8	2264.6
RU	2948.8	2722.5	2496.3	2270.0	2043.7	1817.4	1591.1	1364.8	1138.6	912.3

RAU = 2138.1 (kN); RA2 = 1996.1 (kN)

Current CAPWAP Ru = 2398.4 (kN); Corresponding J(RP)= 0.24; J(RX) = 0.35

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
6.19	21.16	2504.3	2707.3	2716.1	38.826	7.998	8.000	68.3	2917.4

PILE PROFILE AND PILE MODEL

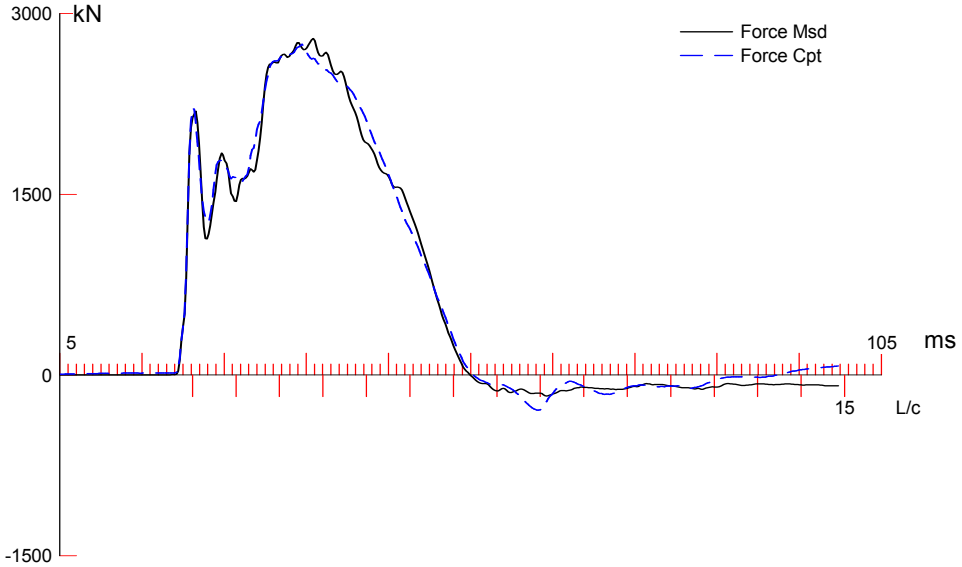
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
27.10	98.61	210000.0	78.500	1.018

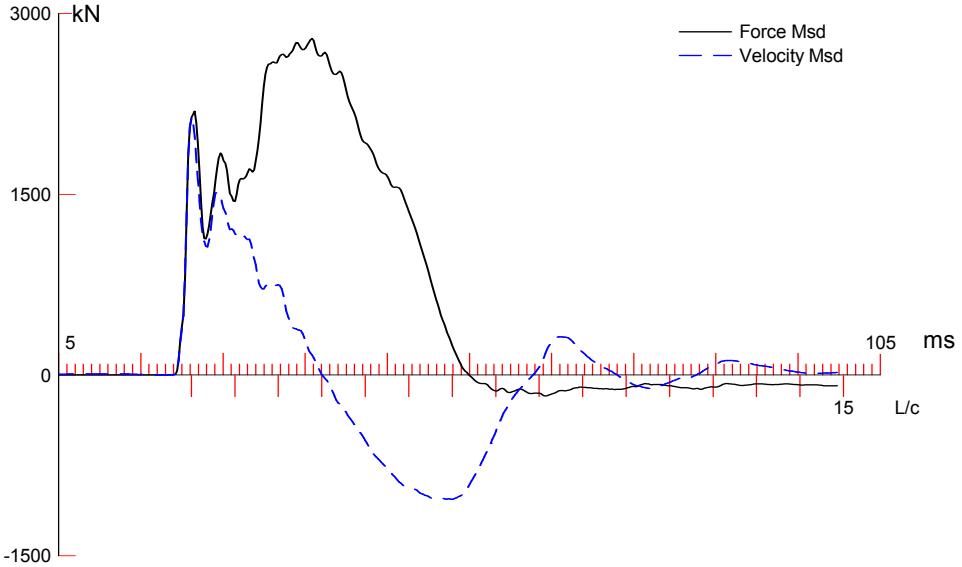
Koepaalutus Tuuliharju; Pile: TU-T2 24h — Test: 05-Mar-2015 10:54:
Junttan HHK 5A; Blow: 7 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

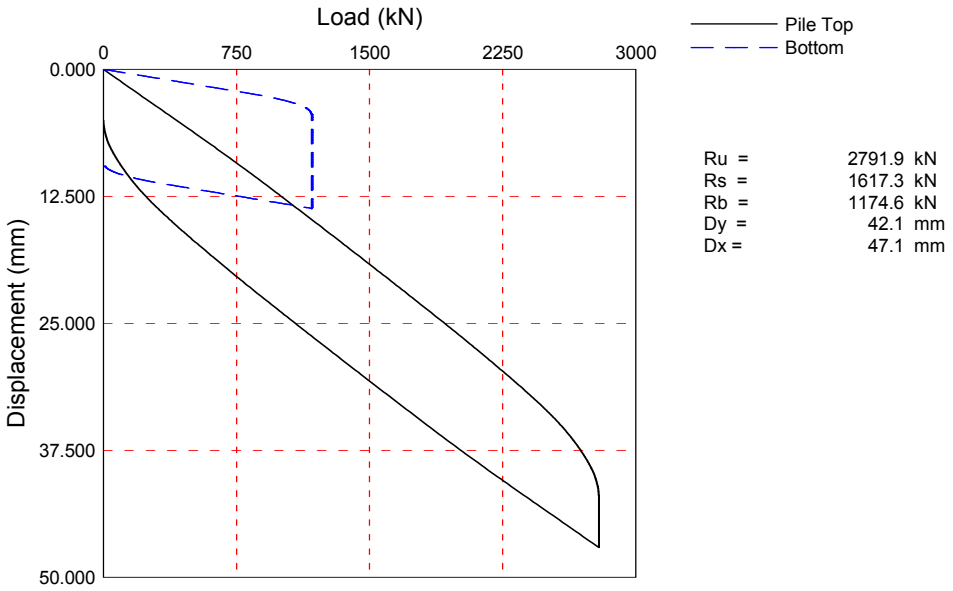
Toe Area 0.082 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.00	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.01	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.01
27	27.10	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.01

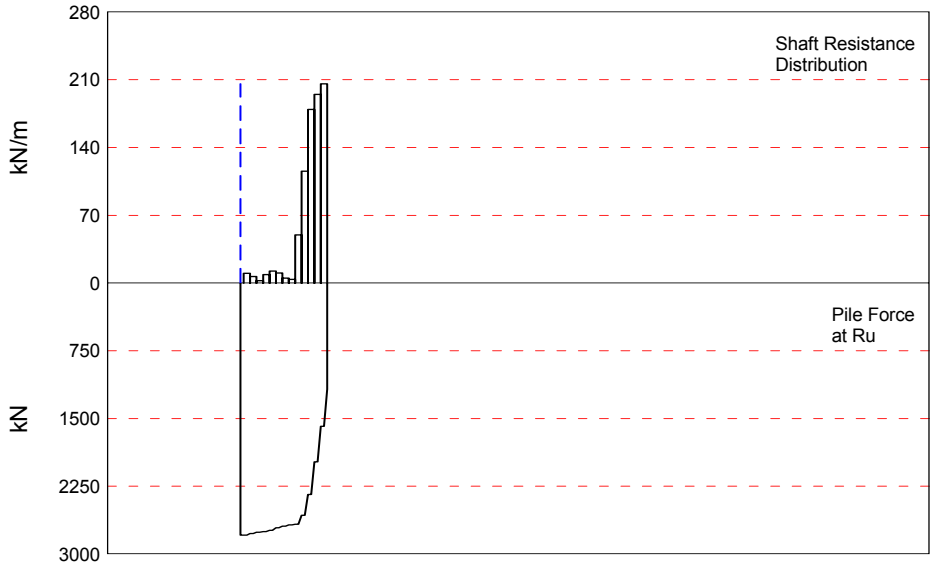
Pile Damping 1.0 %, Time Incr 0.196 ms, Wave Speed 5121.9 m/s, 2L/c 10.6 ms







Ru = 2791.9 kN
Rs = 1617.3 kN
Rb = 1174.6 kN
Dy = 42.1 mm
Dx = 47.1 mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Zatelliitin koepaalutus 14vrk; Pile: TU-T2 14 vrk Test: 18-Mar-2015 14:44:
Junttan HHK 7A; Blow: 10 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2791.9; along Shaft 1617.3; at Toe 1174.6 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				2791.9				
1	3.0	3.0	20.2	2771.7	20.2	6.71	6.59	0.797
2	5.0	5.0	13.5	2758.2	33.7	6.73	6.61	0.797
3	7.0	7.0	5.0	2753.2	38.7	2.49	2.45	0.797
4	9.0	9.0	17.8	2735.4	56.5	8.87	8.71	0.797
5	11.0	11.0	25.2	2710.2	81.7	12.55	12.34	0.797
6	13.0	13.0	20.9	2689.3	102.6	10.41	10.23	0.797
7	15.1	15.1	10.3	2679.0	112.9	5.13	5.04	0.797
8	17.1	17.1	8.0	2671.0	120.9	3.99	3.92	0.797
9	19.1	19.1	100.2	2570.8	221.1	49.92	49.05	0.797
10	21.1	21.1	231.8	2339.0	452.9	115.47	113.48	0.797
11	23.1	23.1	360.1	1978.9	813.0	179.39	176.29	0.797
12	25.1	25.1	391.4	1587.5	1204.4	194.98	191.61	0.797
13	27.1	27.1	412.9	1174.6	1617.3	205.69	202.14	0.797
Avg. Shaft			124.4			59.68	58.65	0.797
Toe			1174.6				14255.36	0.080

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	6.678	3.392
Case Damping Factor		3.189	0.232
Unloading Quake	(% of loading quake)	86	110
Reloading Level	(% of Ru)	100	100
Resistance Gap (included in Toe Quake)	(mm)		0.242
Soil Plug Weight	(kN)		0.28

CAPWAP match quality = 2.05 (Force Match) ; RSA = 0
Observed: final set = 5.000 mm; blow count = 200 b/m
Computed: final set = 4.155 mm; blow count = 241 b/m

max. Top Comp. Stress = 278.3 MPa (T= 34.7 ms, max= 1.048 x Top)
max. Comp. Stress = 291.7 MPa (Z= 19.1 m, T= 36.1 ms)
max. Tens. Stress = -43.57 MPa (Z= 19.1 m, T= 60.2 ms)
max. Energy (EMX) = 72.18 kJ; max. Measured Top Displ. (DMX)=39.27 mm

Zatelliitin koepaalutus 14vrk; Pile: TU-T2 14 vrk Test: 18-Mar-2015 14:44:
Junttan HHK 7A; Blow: 10 CAPWAP(R) 2006-2
Inspecta OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2744.7	-291.9	278.3	-29.60	72.18	5.2	38.034
2	2.0	2770.5	-321.0	280.9	-32.56	70.79	5.2	36.777
4	4.0	2808.3	-326.9	284.8	-33.15	65.27	5.1	34.249
6	6.0	2816.8	-330.4	285.6	-33.50	60.55	5.0	31.695
8	8.0	2830.1	-332.3	287.0	-33.70	56.64	4.9	29.105
10	10.0	2836.5	-317.7	287.6	-32.21	51.69	4.8	26.483
12	12.0	2825.9	-339.2	286.6	-34.40	46.40	4.7	23.853
13	13.0	2835.5	-366.3	287.5	-37.15	44.63	4.7	22.544
14	14.1	2815.6	-364.1	285.5	-36.93	41.68	4.7	21.248
15	15.1	2830.8	-386.7	287.1	-39.22	39.96	4.6	19.957
16	16.1	2834.1	-392.0	287.4	-39.75	37.76	4.6	18.676
17	17.1	2852.7	-407.7	289.3	-41.35	36.09	4.4	17.404
18	18.1	2858.7	-413.4	289.9	-41.92	34.13	4.1	16.145
19	19.1	2876.9	-429.7	291.7	-43.57	32.52	3.9	14.900
20	20.1	2748.5	-326.6	278.7	-33.12	28.11	3.5	13.717
21	21.1	2764.6	-339.9	280.3	-34.47	26.72	3.1	12.555
22	22.1	2485.4	-181.3	252.0	-18.38	21.04	2.7	11.508
23	23.1	2494.0	-186.7	252.9	-18.93	19.95	2.3	10.479
24	24.1	2108.7	-48.5	213.8	-4.91	14.65	2.0	9.574
25	25.1	2114.6	-51.8	214.4	-5.25	13.81	1.8	8.677
26	26.1	1718.3	-0.1	174.2	-0.01	9.93	1.7	7.900
27	27.1	1722.8	-0.1	174.7	-0.01	6.62	1.5	7.124
Absolute	19.1			291.7			(T =	36.1 ms)
	19.1				-43.57		(T =	60.2 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3115.8	2991.5	2867.3	2743.1	2618.8	2494.6	2370.4	2246.1	2121.9	1997.7
RX	3115.8	2996.5	2885.0	2846.7	2808.3	2771.2	2755.7	2752.9	2750.2	2750.2
RU	3115.8	2991.5	2867.3	2743.1	2618.8	2494.6	2370.4	2246.1	2121.9	1997.7

RAU = 2256.2 (kN); RA2 = 2256.2 (kN)

Current CAPWAP Ru = 2791.9 (kN); Corresponding J(RP)= 0.26; J(RX) = 0.44

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
5.31	21.36	2148.2	2209.9	2795.7	39.273	5.000	5.000	72.7	3283.3

PILE PROFILE AND PILE MODEL

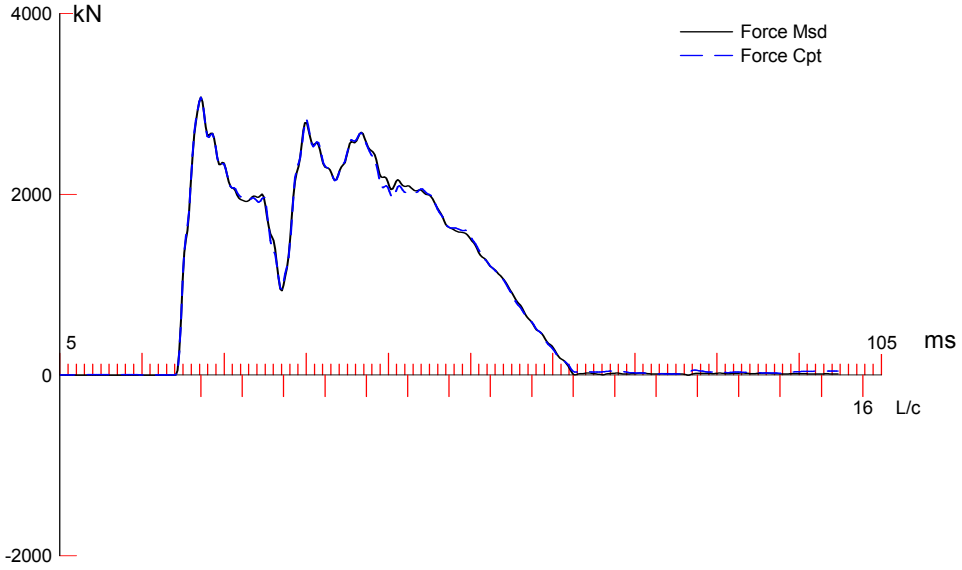
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
27.10	98.61	210000.0	78.500	1.018

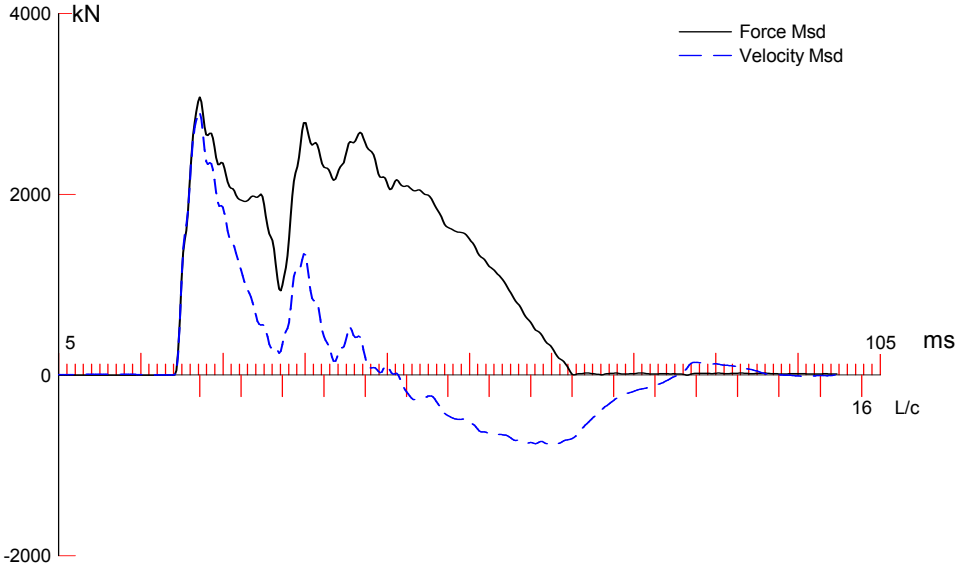
Zatelliitin koepaalutus 14vrk; Pile: TU-T2 14 vrk Test: 18-Mar-2015 14:44:
Junttan HHK 7A; Blow: 10 CAPWAP(R) 2006-2
Inspecta OP: TRe

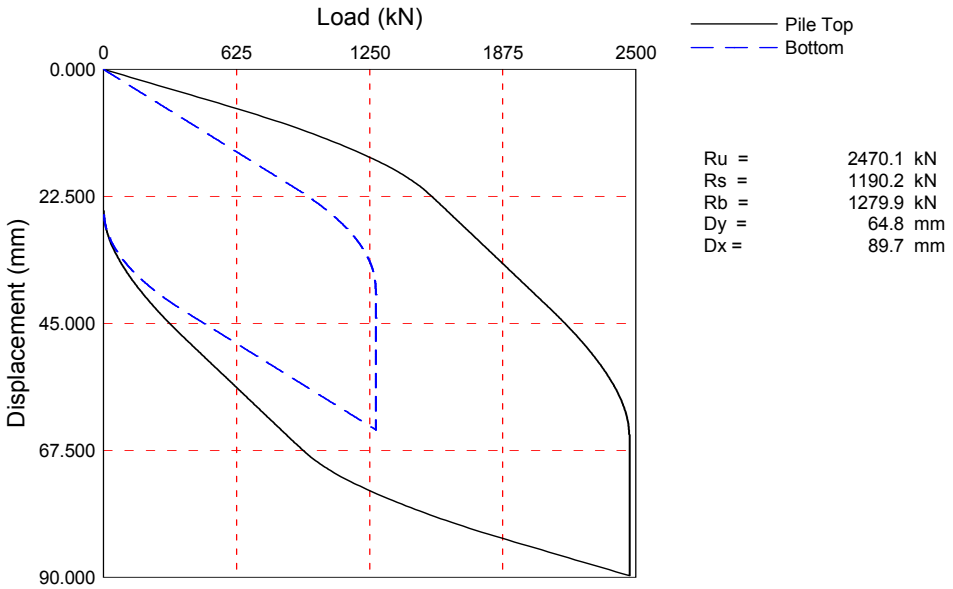
Toe Area 0.082 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.00	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.01	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.03
27	27.10	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.03

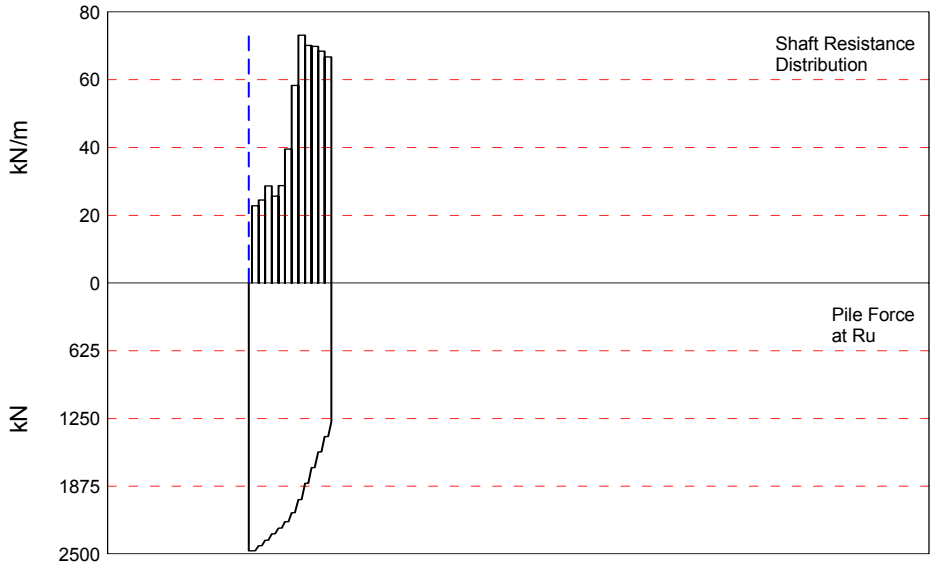
Pile Damping 1.0 %, Time Incr 0.196 ms, Wave Speed 5121.9 m/s, 2L/c 10.6 ms







Ru	=	2470.1 kN
Rs	=	1190.2 kN
Rb	=	1279.9 kN
Dy	=	64.8 mm
Dx	=	89.7 mm



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Tuuliharjun koepaalutus; Pile: TU-T3 Test: 31-Mar-2015 09:19:
Vapaapudotusjarkale 9t; Blow: 18 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2470.1; along Shaft 1190.2; at Toe 1279.9 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				2470.1				
1	3.1	3.1	47.1	2423.0	47.1	15.21	14.95	0.138
2	5.2	5.2	50.6	2372.4	97.7	24.52	24.09	0.138
3	7.2	7.2	59.2	2313.2	156.9	28.68	28.19	0.138
4	9.3	9.3	52.9	2260.3	209.8	25.63	25.19	0.138
5	11.4	11.4	59.3	2201.0	269.1	28.73	28.23	0.138
6	13.4	13.4	81.6	2119.4	350.7	39.53	38.85	0.138
7	15.5	15.5	120.5	1998.9	471.2	58.38	57.37	0.138
8	17.5	17.5	151.0	1847.9	622.2	73.16	71.90	0.138
9	19.6	19.6	144.8	1703.1	767.0	70.16	68.94	0.138
10	21.7	21.7	144.2	1558.9	911.2	69.86	68.66	0.138
11	23.7	23.7	141.3	1417.6	1052.5	68.46	67.28	0.138
12	25.8	25.8	137.7	1279.9	1190.2	66.72	65.56	0.138
Avg. Shaft			99.2			46.13	45.34	0.138
Toe			1279.9				15533.31	0.175

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	6.738	29.904
Case Damping Factor		0.406	0.554
Unloading Quake	(% of loading quake)	164	110
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	34	
Resistance Gap (included in Toe Quake)	(mm)		5.739
Soil Plug Weight	(kN)		0.44
Soil Support Dashpot		1.400	9.404
Soil Support Weight	(kN)	10.50	10.50

CAPWAP match quality = 1.42 (Wave Up Match) ; RSA = 0
Observed: final set = 25.000 mm; blow count = 40 b/m
Computed: final set = 18.810 mm; blow count = 53 b/m

max. Top Comp. Stress = 314.1 MPa (T= 22.6 ms, max= 1.016 x Top)
max. Comp. Stress = 319.0 MPa (Z= 3.1 m, T= 23.0 ms)
max. Tens. Stress = -5.42 MPa (Z= 13.4 m, T= 70.7 ms)
max. Energy (EMX) = 139.82 kJ; max. Measured Top Displ. (DMX)=60.16 mm

Tuuliharjun koepaalutus; Pile: TU-T3 Test: 31-Mar-2015 09:19:
Vapaapudotusjarkale 9t; Blow: 18 CAPWAP(R) 2006-2
Inspecta OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3097.4	-0.4	314.1	-0.05	139.82	7.1	59.659
2	2.1	3121.9	-12.4	316.6	-1.26	138.70	7.1	58.598
4	4.1	3080.0	-28.0	312.3	-2.84	132.54	7.0	56.466
6	6.2	3034.3	-37.6	307.7	-3.81	126.40	6.8	54.384
8	8.3	2976.7	-32.9	301.9	-3.34	119.69	6.7	52.252
9	9.3	3007.1	-51.5	304.9	-5.22	118.60	6.6	51.210
10	10.3	2946.7	-39.5	298.8	-4.01	113.76	6.5	50.178
11	11.4	2986.5	-50.7	302.8	-5.14	112.65	6.4	49.133
12	12.4	2928.4	-36.0	297.0	-3.65	107.59	6.3	48.105
13	13.4	2980.4	-53.4	302.2	-5.42	106.48	6.2	47.058
14	14.4	2895.6	-24.3	293.6	-2.46	100.26	6.0	46.049
15	15.5	2952.5	-41.2	299.4	-4.18	99.38	5.9	45.119
16	16.5	2806.6	-2.0	284.6	-0.20	91.44	5.7	44.248
17	17.5	2859.2	-10.5	289.9	-1.07	90.68	5.6	43.383
18	18.6	2672.3	-2.3	271.0	-0.23	81.55	5.4	42.589
19	19.6	2709.4	-2.5	274.7	-0.25	80.88	5.3	41.780
20	20.6	2418.0	-2.6	245.2	-0.26	72.46	5.6	41.017
21	21.7	2267.9	-2.7	230.0	-0.27	71.87	5.8	40.254
22	22.7	2006.6	-2.8	203.5	-0.28	63.83	5.8	39.563
23	23.7	1956.9	-2.8	198.4	-0.28	63.33	6.0	38.853
24	24.8	1779.0	-2.8	180.4	-0.28	55.71	6.1	38.203
25	25.8	1756.7	-3.4	178.1	-0.34	49.26	5.9	37.552
Absolute	3.1			319.0			(T =	23.0 ms)
	13.4				-5.42		(T =	70.7 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3339.6	3071.1	2802.6	2534.1	2265.7	1997.2	1728.7	1460.2	1191.7	923.2
RX	3339.6	3071.1	2876.9	2769.6	2663.3	2560.7	2461.1	2390.3	2368.5	2361.4
RU	3339.6	3071.1	2802.6	2534.1	2265.7	1997.2	1728.7	1460.2	1191.7	923.2

RAU = 2040.6 (kN); RA2 = 2506.7 (kN)

Current CAPWAP Ru = 2470.1 (kN); Corresponding J(RP)= 0.32; J(RX) = 0.59

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
7.25	22.36	2931.0	3093.5	3093.5	60.155	25.159	25.000	139.7	3279.9

PILE PROFILE AND PILE MODEL

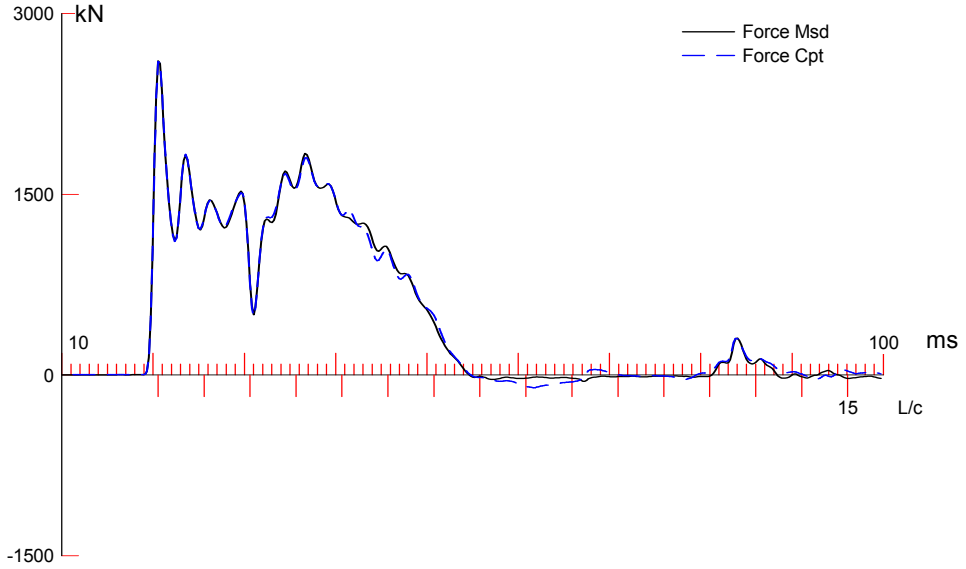
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
25.80	98.61	210000.0	78.500	1.018

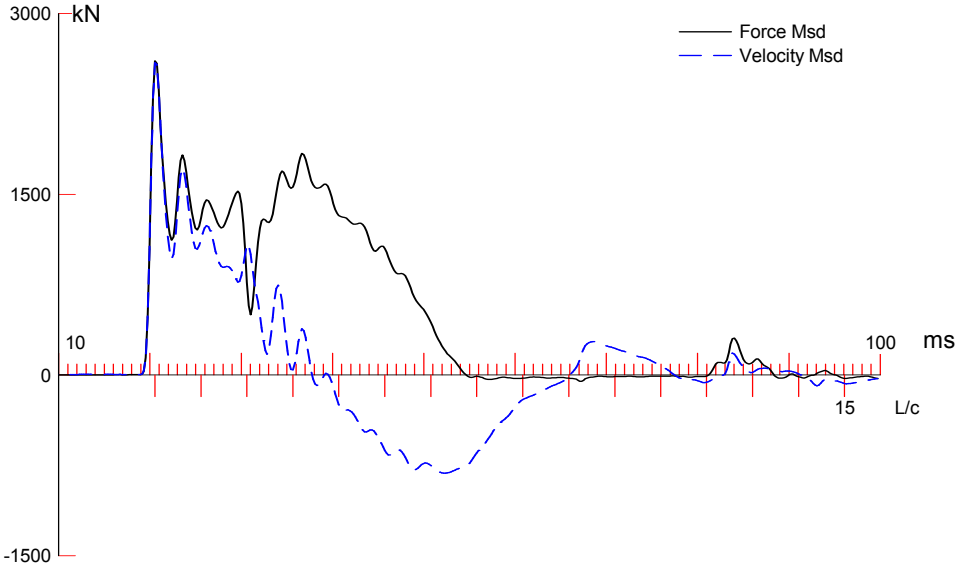
Tuuliharjun koepaalutus; Pile: TU-T3 Test: 31-Mar-2015 09:19:
Vapaapudotusjarkale 9t; Blow: 18 CAPWAP(R) 2006-2
Inspecta OP: TRe

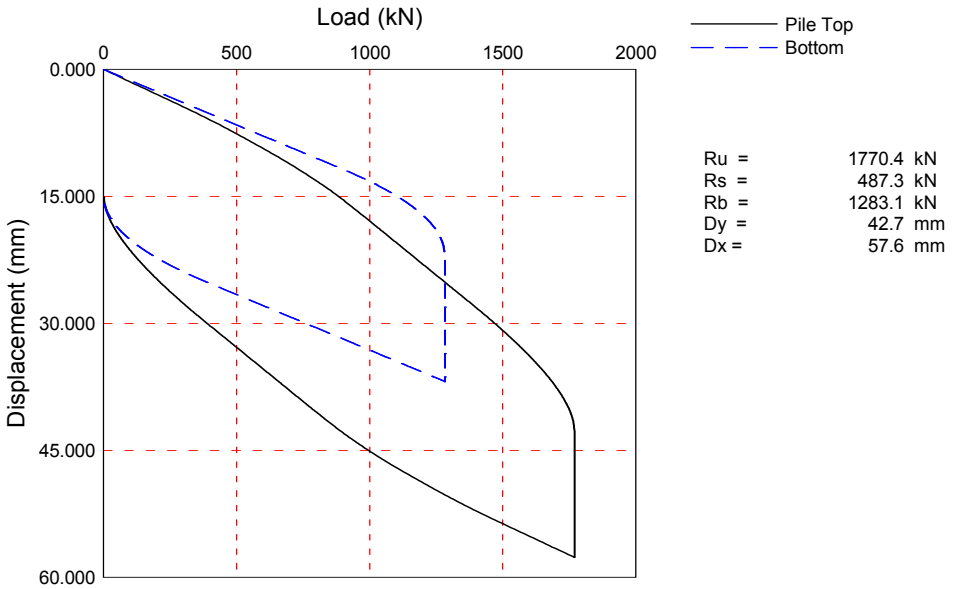
Toe Area 0.082 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.03	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.06	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02
3	3.10	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02
25	25.80	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02

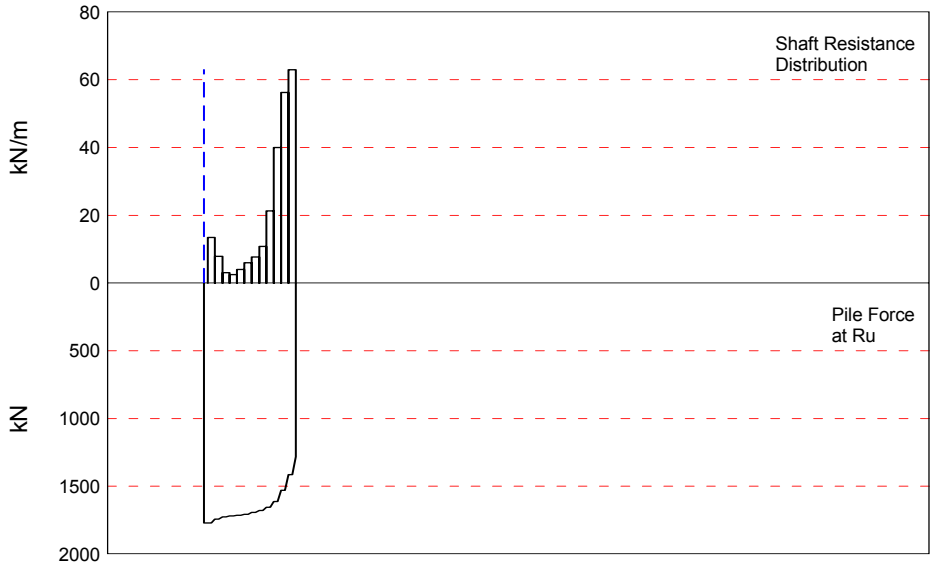
Pile Damping 1.0 %, Time Incr 0.201 ms, Wave Speed 5121.9 m/s, 2L/c 10.1 ms







Ru = 1770.4 kN
Rs = 487.3 kN
Rb = 1283.1 kN
Dy = 42.7 mm
Dx = 57.6 mm



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Koepaalutus Tuuliharju; Pile: TU-T3 24h — Test: 05-Mar-2015 10:44:
Junttan HHK 5A; Blow: 9 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1770.4; along Shaft 487.3; at Toe 1283.1 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				1770.4				
1	3.1	3.1	27.9	1742.5	27.9	9.01	8.86	0.410
2	5.2	5.2	16.3	1726.2	44.2	7.90	7.76	0.410
3	7.2	7.2	6.4	1719.8	50.6	3.10	3.05	0.410
4	9.3	9.3	5.1	1714.7	55.7	2.47	2.43	0.410
5	11.4	11.4	8.3	1706.4	64.0	4.02	3.95	0.410
6	13.4	13.4	12.4	1694.0	76.4	6.01	5.90	0.410
7	15.5	15.5	15.9	1678.1	92.3	7.70	7.57	0.410
8	17.5	17.5	22.4	1655.7	114.7	10.85	10.67	0.410
9	19.6	19.6	44.0	1611.7	158.7	21.32	20.95	0.410
10	21.7	21.7	82.5	1529.2	241.2	39.97	39.28	0.410
11	23.7	23.7	116.2	1413.0	357.4	56.30	55.33	0.410
12	25.8	25.8	129.9	1283.1	487.3	62.94	61.85	0.410
Avg. Shaft			40.6			18.89	18.56	0.410
Toe			1283.1				15572.15	0.082

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	4.947	16.839
Case Damping Factor		0.494	0.262
Unloading Quake	(% of loading quake)	151	48
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	60	
Resistance Gap (included in Toe Quake)	(mm)		1.329
Soil Plug Weight	(kN)		0.43
Soil Support Dashpot		2.400	8.952
Soil Support Weight	(kN)	10.50	10.50

CAPWAP match quality = 1.79 (Wave Up Match) ; RSA = 0
Observed: final set = 15.000 mm; blow count = 67 b/m
Computed: final set = 14.846 mm; blow count = 67 b/m

max. Top Comp. Stress = 264.3 MPa (T= 21.0 ms, max= 1.013 x Top)
max. Comp. Stress = 267.7 MPa (Z= 3.1 m, T= 21.4 ms)
max. Tens. Stress = -30.18 MPa (Z= 17.5 m, T= 58.6 ms)
max. Energy (EMX) = 62.37 kJ; max. Measured Top Displ. (DMX)=41.54 mm

Koepaalutus Tuuliharju; Pile: TU-T3 24h — Test: 05-Mar-2015 10:44:
Junttan HHK 5A; Blow: 9 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2606.7	-112.8	264.3	-11.44	62.37	6.4	40.659
2	2.1	2622.9	-124.9	266.0	-12.67	61.68	6.4	39.832
4	4.1	2563.9	-140.0	260.0	-14.20	58.04	6.3	38.235
6	6.2	2524.5	-156.0	256.0	-15.82	55.55	6.2	36.719
8	8.3	2508.3	-188.8	254.4	-19.14	53.85	6.2	35.178
9	9.3	2513.8	-211.1	254.9	-21.40	53.18	6.2	34.357
10	10.3	2504.4	-224.4	254.0	-22.76	52.07	6.1	33.512
11	11.4	2512.7	-239.9	254.8	-24.32	51.40	6.1	32.696
12	12.4	2495.9	-246.7	253.1	-25.02	50.27	6.1	31.978
13	13.4	2506.9	-263.3	254.2	-26.70	49.78	6.1	31.278
14	14.4	2480.4	-272.0	251.5	-27.58	48.41	6.0	30.549
15	15.5	2495.1	-287.7	253.0	-29.18	47.82	6.0	29.791
16	16.5	2463.8	-287.3	249.8	-29.13	46.29	5.9	29.062
17	17.5	2488.9	-297.6	252.4	-30.18	45.80	5.9	28.364
18	18.6	2454.7	-278.5	248.9	-28.24	43.95	5.8	27.658
19	19.6	2499.6	-277.0	253.5	-28.09	43.39	5.7	26.912
20	20.6	2429.2	-242.3	246.3	-24.57	40.38	5.6	26.149
21	21.7	2493.9	-247.3	252.9	-25.07	39.82	5.4	25.418
22	22.7	2336.0	-198.5	236.9	-20.13	35.38	5.2	24.760
23	23.7	2319.1	-201.6	235.2	-20.44	34.98	5.3	24.128
24	24.8	1804.4	-141.5	183.0	-14.35	29.33	6.3	23.531
25	25.8	1494.1	-141.1	151.5	-14.31	23.61	7.0	22.897
Absolute	3.1			267.7			(T =	21.4 ms)
	17.5				-30.18		(T =	58.6 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	2426.0	2134.2	1842.3	1550.4	1258.6	966.7	674.9	383.0	91.1	0.0
RX	2426.0	2134.2	1960.6	1898.4	1837.4	1779.8	1744.1	1724.0	1712.5	1707.3
RU	2426.0	2134.2	1842.3	1550.4	1258.6	966.7	674.9	383.0	91.1	0.0

RAU = 1572.1 (kN); RA2 = 1872.9 (kN)

Current CAPWAP Ru = 1770.4 (kN); Corresponding J(RP)= 0.22; J(RX) = 0.53

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
6.59	20.75	2664.7	2680.0	2680.0	41.541	15.019	15.000	63.3	2239.2

Koepaalutus Tuuliharju; Pile: TU-T3 24h — Test: 05-Mar-2015 10:44:
Junttan HHK 5A; Blow: 9 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

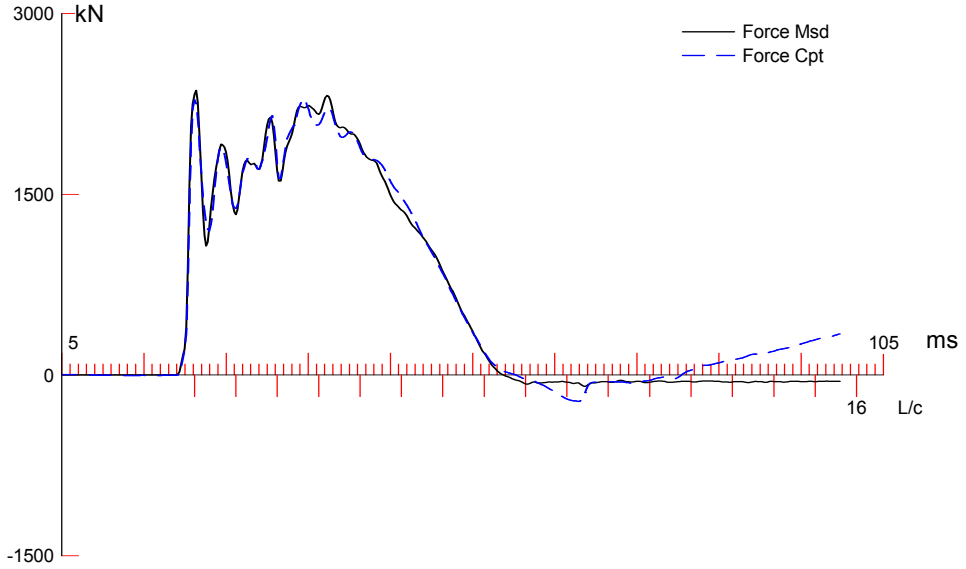
PILE PROFILE AND PILE MODEL

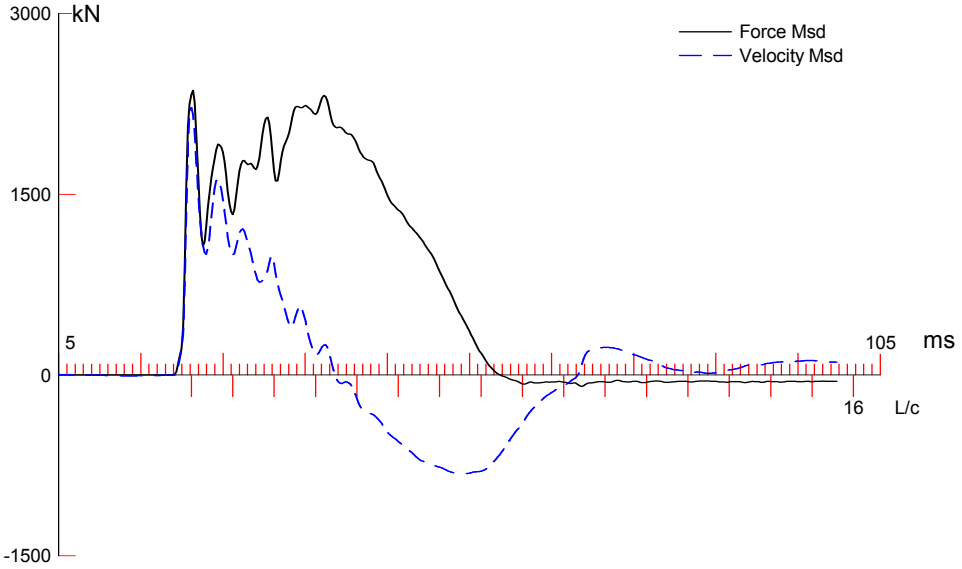
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
25.80	98.61	210000.0	78.500	1.018

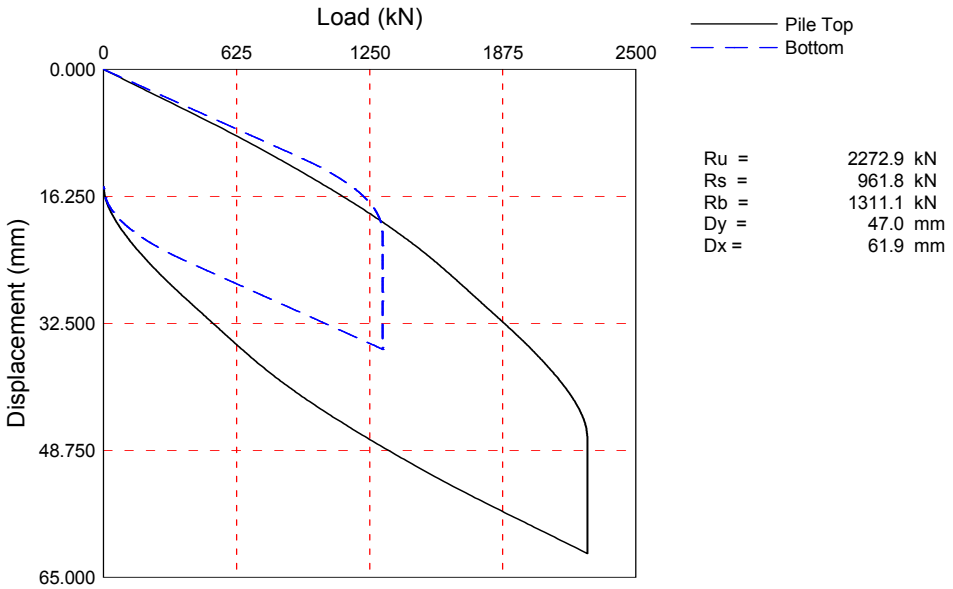
Toe Area 0.082 m^2

Top Segment Length 1.03 m, Top Impedance 404.32 kN/m/s

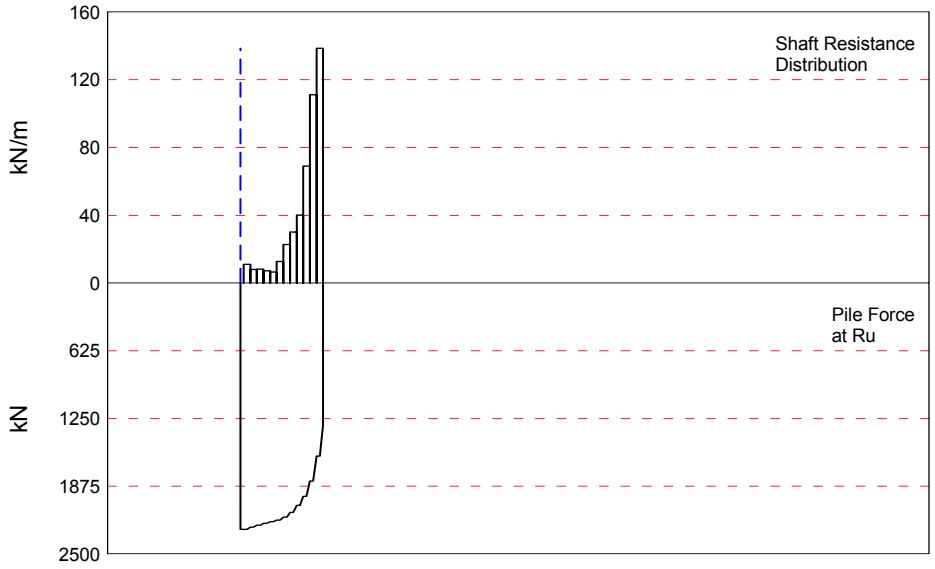
Pile Damping 1.0 %, Time Incr 0.201 ms, Wave Speed 5121.9 m/s, 2L/c 10.1 ms







Ru =	2272.9	kN
Rs =	961.8	kN
Rb =	1311.1	kN
Dy =	47.0	mm
Dx =	61.9	mm



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Zatelliitin koepaalutus 14vrk; Pile: TU-T3 14 vrk — Test: 18-Mar-2015 14:56:
Junttan HHK 7A; Blow: 8 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2272.9; along Shaft 961.8; at Toe 1311.1 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				2272.9				
1	3.1	3.1	22.9	2250.0	22.9	7.40	7.27	0.618
2	5.2	5.2	16.6	2233.4	39.5	8.04	7.90	0.618
3	7.2	7.2	17.0	2216.4	56.5	8.24	8.09	0.618
4	9.3	9.3	15.1	2201.3	71.6	7.32	7.19	0.618
5	11.4	11.4	13.5	2187.8	85.1	6.54	6.43	0.618
6	13.4	13.4	26.5	2161.3	111.6	12.84	12.62	0.618
7	15.5	15.5	47.1	2114.2	158.7	22.82	22.43	0.618
8	17.5	17.5	62.1	2052.1	220.8	30.09	29.57	0.618
9	19.6	19.6	83.0	1969.1	303.8	40.21	39.52	0.618
10	21.7	21.7	142.5	1826.6	446.3	69.04	67.85	0.618
11	23.7	23.7	229.4	1597.2	675.7	111.14	109.23	0.618
12	25.8	25.8	286.1	1311.1	961.8	138.61	136.22	0.618
Avg. Shaft			80.1			37.28	36.64	0.618
Toe			1311.1				15911.97	0.277

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	6.559	16.011
Case Damping Factor		1.470	0.898
Damping Type			Smith
Unloading Quake	(% of loading quake)	108	55
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	87	
Resistance Gap (included in Toe Quake)	(mm)		1.199
Soil Support Dashpot		2.994	0.000
Soil Support Weight	(kN)	10.50	0.00

CAPWAP match quality = 1.92 (Force Match) ; RSA = 0
Observed: final set = 15.000 mm; blow count = 67 b/m
Computed: final set = 4.022 mm; blow count = 249 b/m

max. Top Comp. Stress = 232.5 MPa (T= 34.7 ms, max= 1.033 x Top)
max. Comp. Stress = 240.1 MPa (Z= 5.2 m, T= 35.7 ms)
max. Tens. Stress = -25.19 MPa (Z= 7.2 m, T= 68.7 ms)
max. Energy (EMX) = 71.29 kJ; max. Measured Top Displ. (DMX)=40.74 mm

Zatelliitin koepaalutus 14vrk; Pile: TU-T3 14 vrk — Test: 18-Mar-2015 14:56:
Junttan HHK 7A; Blow: 8 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2292.5	-218.4	232.5	-22.15	71.29	5.4	39.722
2	2.1	2332.9	-238.6	236.6	-24.20	70.57	5.4	38.695
4	4.1	2341.9	-237.8	237.5	-24.11	66.16	5.3	36.627
6	6.2	2356.2	-240.7	238.9	-24.41	62.47	5.2	34.556
8	8.3	2341.0	-240.2	237.4	-24.36	58.89	5.1	32.492
9	9.3	2350.0	-244.5	238.3	-24.79	57.80	5.1	31.456
10	10.3	2336.4	-235.0	236.9	-23.83	55.55	5.0	30.421
11	11.4	2350.2	-236.8	238.3	-24.01	54.45	5.0	29.380
12	12.4	2343.9	-226.9	237.7	-23.01	52.41	4.9	28.339
13	13.4	2356.6	-228.4	239.0	-23.16	51.30	4.9	27.293
14	14.4	2325.5	-208.7	235.8	-21.16	48.58	4.8	26.258
15	15.5	2342.8	-209.0	237.6	-21.19	47.49	4.7	25.223
16	16.5	2270.2	-172.6	230.2	-17.50	43.91	4.6	24.212
17	17.5	2280.7	-175.9	231.3	-17.84	42.88	4.4	23.204
18	18.6	2202.2	-130.2	223.3	-13.20	38.94	4.3	22.226
19	19.6	2214.6	-141.5	224.6	-14.35	37.97	4.1	21.248
20	20.6	2115.7	-86.0	214.5	-8.73	33.73	3.9	20.307
21	21.7	2130.2	-96.1	216.0	-9.75	32.83	3.7	19.366
22	22.7	1968.8	-30.5	199.7	-3.09	27.43	3.5	18.485
23	23.7	1982.6	-37.9	201.0	-3.85	26.65	3.8	17.608
24	24.8	1742.8	-2.5	176.7	-0.25	19.72	4.3	16.818
25	25.8	1755.3	-2.3	178.0	-0.24	12.15	4.2	16.033
Absolute	5.2			240.1			(T =	35.7 ms)
	7.2				-25.19		(T =	68.7 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	2675.9	2483.5	2291.1	2098.6	1906.2	1713.8	1521.4	1328.9	1136.5	944.1
RX	2675.9	2513.3	2464.3	2417.3	2370.2	2323.2	2276.2	2229.7	2185.9	2150.0
RU	2675.9	2483.5	2291.1	2098.6	1906.2	1713.8	1521.4	1328.9	1136.5	944.1

RAU = 1560.7 (kN); RA2 = 2262.3 (kN)

Current CAPWAP Ru = 2272.9 (kN); Corresponding J(RP)= 0.21; J(RX) = 0.61

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
5.58	21.36	2254.7	2345.5	2407.4	40.736	15.008	15.000	73.9	2650.8

PILE PROFILE AND PILE MODEL

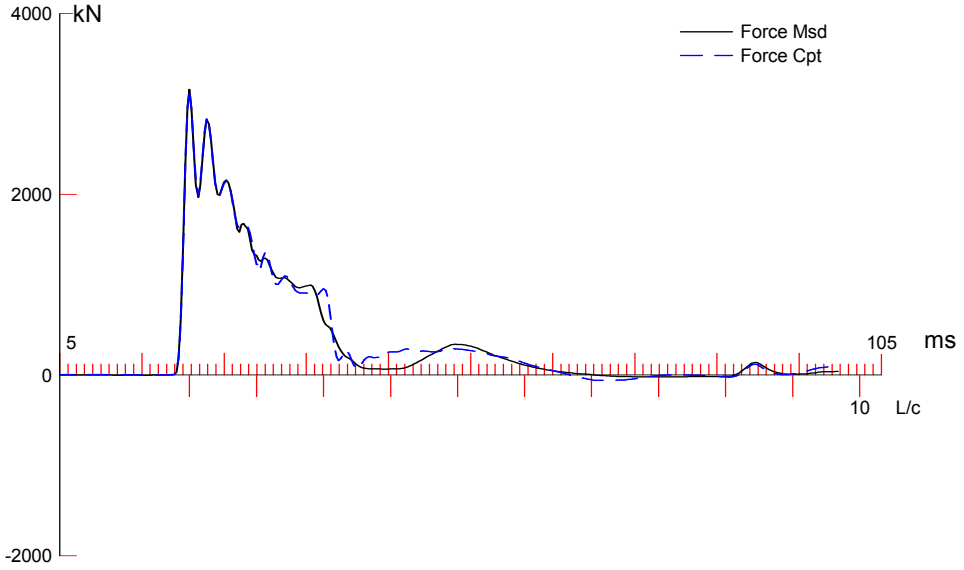
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
25.80	98.61	210000.0	78.500	1.018

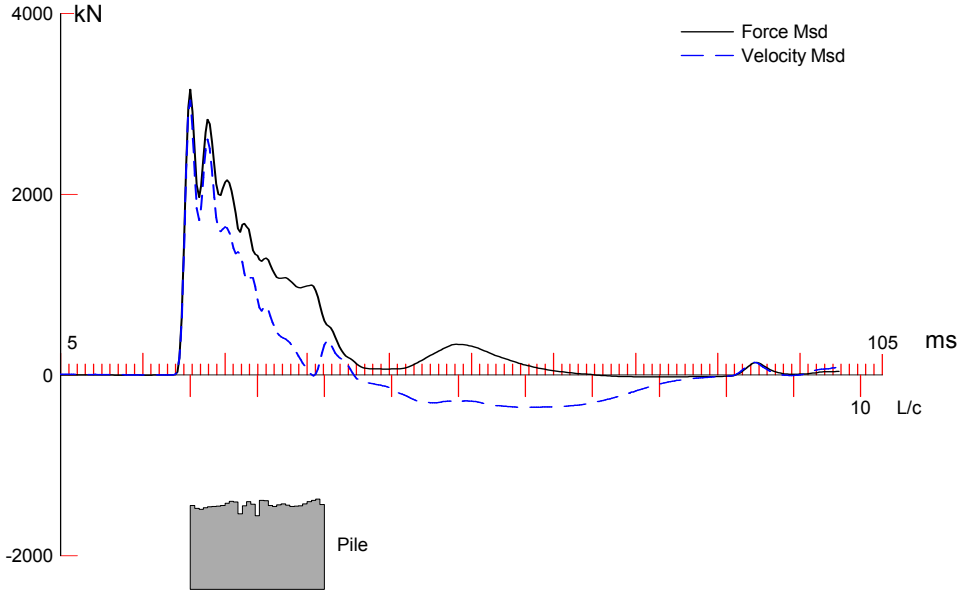
Zatelliitin koepaalutus 14vrk; Pile: TU-T3 14 vrk Test: 18-Mar-2015 14:56:
Junttan HHK 7A; Blow: 8 CAPWAP(R) 2006-2
Inspecta OP: TRe

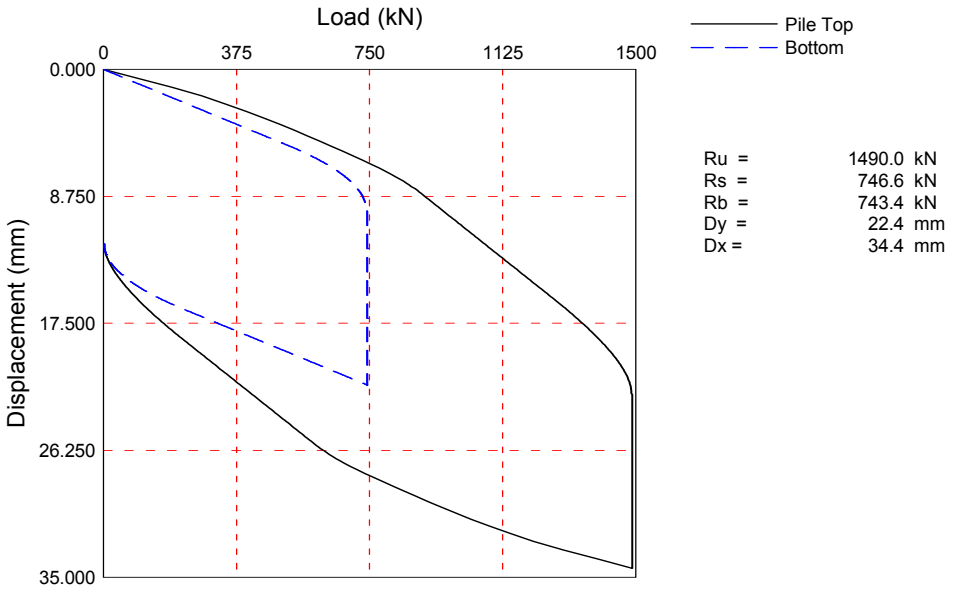
Toe Area 0.082 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.03	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.06	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.04
3	3.10	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.04
25	25.80	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.04

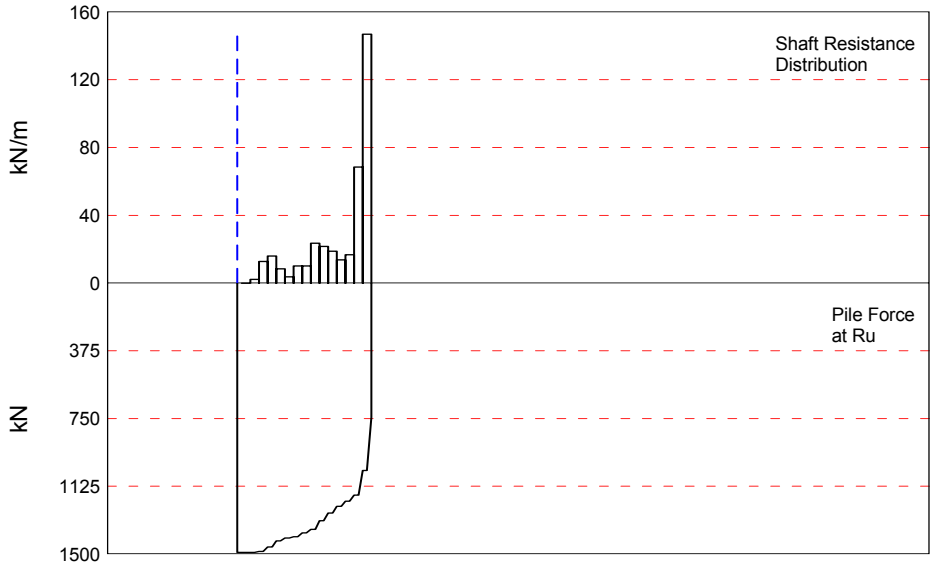
Pile Damping 1.0 %, Time Incr 0.201 ms, Wave Speed 5121.9 m/s, 2L/c 10.1 ms







Ru	=	1490.0 kN
Rs	=	746.6 kN
Rb	=	743.4 kN
Dy	=	22.4 mm
Dx	=	34.4 mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Koepaalutus Zatelliitti; Pile: ZEB1 Test: 04-Mar-2015 15:59:
Junttan HHK 5A; Blow: 15 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1490.0; along Shaft 746.6; at Toe 743.4 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				1490.0				
1	3.0	3.0	0.0	1490.0	0.0	0.00	0.00	0.000
2	5.0	5.0	4.5	1485.5	4.5	2.25	1.88	1.074
3	7.0	7.0	25.4	1460.1	29.9	12.70	10.58	1.074
4	9.0	9.0	32.0	1428.1	61.9	16.00	13.33	1.074
5	11.0	11.0	16.8	1411.3	78.7	8.40	7.00	1.074
6	13.0	13.0	7.4	1403.9	86.1	3.70	3.08	1.074
7	15.0	15.0	20.4	1383.5	106.5	10.20	8.50	1.074
8	17.0	17.0	20.3	1363.2	126.8	10.15	8.46	1.074
9	19.0	19.0	46.9	1316.3	173.7	23.45	19.54	1.074
10	21.0	21.0	43.3	1273.0	217.0	21.65	18.04	1.074
11	23.0	23.0	37.7	1235.3	254.7	18.85	15.71	1.074
12	25.0	25.0	27.5	1207.8	282.2	13.75	11.46	1.074
13	27.0	27.0	33.7	1174.1	315.9	16.85	14.04	1.074
14	29.0	29.0	137.1	1037.0	453.0	68.55	57.13	1.074
15	31.0	31.0	293.6	743.4	746.6	146.80	122.33	1.074
Avg. Shaft			49.8			24.08	20.07	1.074
Toe			743.4				8260.00	0.036

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	1.004	7.504
Case Damping Factor		0.920	0.031
Unloading Quake	(% of loading quake)	30	80
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	19	
Soil Support Dashpot		0.700	0.000
Soil Support Weight	(kN)	12.00	0.00

CAPWAP match quality = 3.45 (Wave Up Match) ; RSA = 0
Observed: final set = 12.000 mm; blow count = 83 b/m
Computed: final set = 12.743 mm; blow count = 78 b/m

max. Top Comp. Stress = 35.9 MPa (T= 21.3 ms, max= 1.015 x Top)
max. Comp. Stress = 36.4 MPa (Z= 7.0 m, T= 23.2 ms)
max. Tens. Stress = -1.01 MPa (Z= 7.0 m, T= 72.6 ms)
max. Energy (EMX) = 44.99 kJ; max. Measured Top Displ. (DMX)=22.73 mm

Koepaalutus Zatelliitti; Pile: ZEB1 Test: 04-Mar-2015 15:59:
Junttan HHK 5A; Blow: 15 CAPWAP(R) 2006-2
Inspecta OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3232.3	-64.6	35.9	-0.72	44.99	3.4	22.557
2	2.0	3232.2	-67.7	35.9	-0.75	44.96	3.4	22.509
4	4.0	3258.0	-78.4	36.2	-0.87	44.88	3.3	22.334
6	6.0	3229.8	-86.8	35.9	-0.96	44.49	3.2	22.083
8	8.0	3248.7	-83.2	36.1	-0.92	42.85	3.1	21.814
10	10.0	3068.3	-75.5	34.1	-0.84	40.89	3.2	21.526
12	12.0	3063.6	-72.2	34.0	-0.80	39.74	3.0	21.150
14	14.0	2922.5	-68.0	32.5	-0.76	39.14	3.1	20.741
16	16.0	3041.8	-70.6	33.8	-0.78	37.77	2.9	20.239
18	18.0	2934.9	-76.9	32.6	-0.85	36.48	2.9	19.772
20	20.0	2814.3	-75.8	31.3	-0.84	33.94	2.7	19.293
21	21.0	2857.9	-82.3	31.8	-0.91	33.83	2.7	19.067
22	22.0	2729.0	-76.6	30.3	-0.85	31.64	2.7	18.853
23	23.0	2761.5	-83.6	30.7	-0.93	31.55	2.7	18.640
24	24.0	2646.1	-80.1	29.4	-0.89	29.65	2.7	18.430
25	25.0	2681.0	-86.3	29.8	-0.96	29.56	2.6	18.215
26	26.0	2612.3	-83.7	29.0	-0.93	28.16	2.7	18.007
27	27.0	2657.1	-88.8	29.5	-0.99	28.09	3.0	17.805
28	28.0	2690.3	-83.8	29.9	-0.93	26.39	2.8	17.610
29	29.0	2623.6	-87.5	29.2	-0.97	26.30	2.5	17.414
30	30.0	1799.6	-81.8	20.0	-0.91	20.65	3.0	17.211
31	31.0	1548.3	-61.0	17.2	-0.68	10.70	3.2	16.990
Absolute	7.0			36.4			(T =	23.2 ms)
	7.0				-1.01		(T =	72.6 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3302.0	3000.7	2699.3	2398.0	2096.7	1795.4	1494.1	1192.7	891.4	590.1
RX	3302.0	3000.7	2699.3	2398.0	2096.7	1795.4	1494.1	1192.7	891.4	645.1
RU	3362.8	3067.6	2772.3	2477.1	2181.8	1886.6	1591.4	1296.1	1000.9	705.6

RAU = 597.0 (kN); RA2 = 951.1 (kN)

Current CAPWAP Ru = 1490.0 (kN); Corresponding J(RP)= 0.60; J(RX) = 0.60

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
3.56	21.05	3103.4	3211.7	3211.7	22.727	12.002	12.000	45.3	2606.3

PILE PROFILE AND PILE MODEL

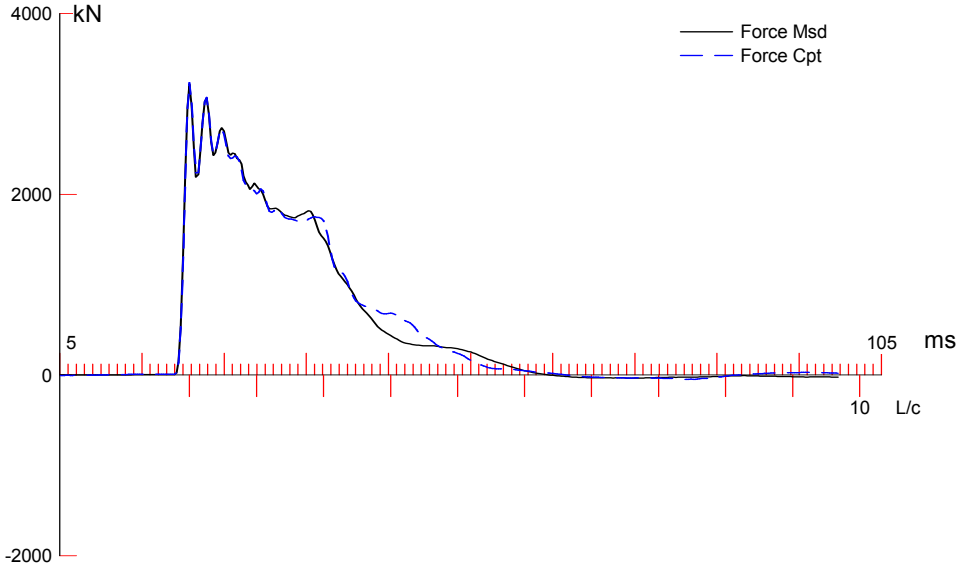
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	900.00	36811.8	25.000	1.200
31.00	900.00	36811.8	25.000	1.200

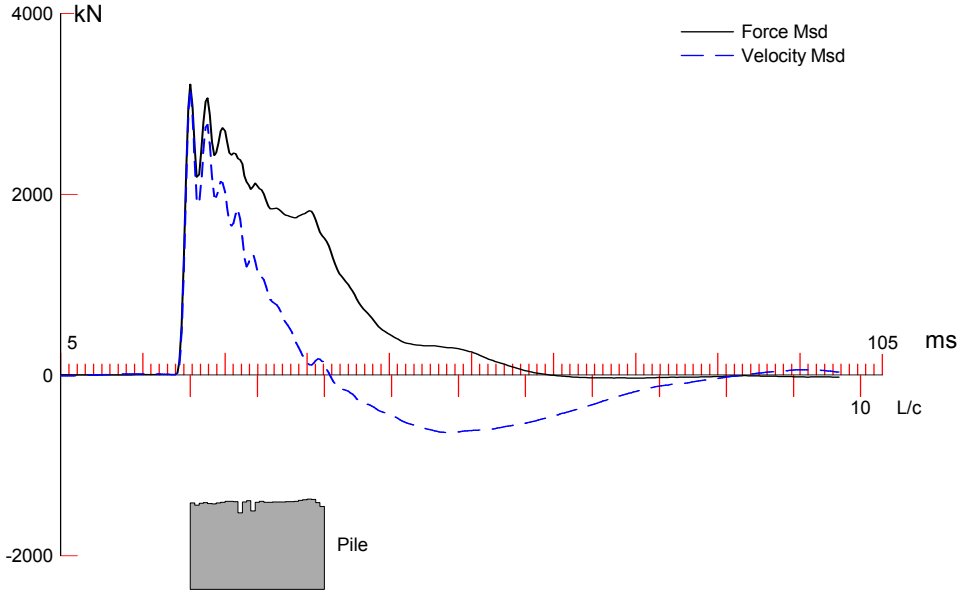
Koepaalutus Zatelliitti; Pile: ZEB1 Test: 04-Mar-2015 15:59:
Junttan HHK 5A; Blow: 15 CAPWAP(R) 2006-2
Inspecta OP: TRe

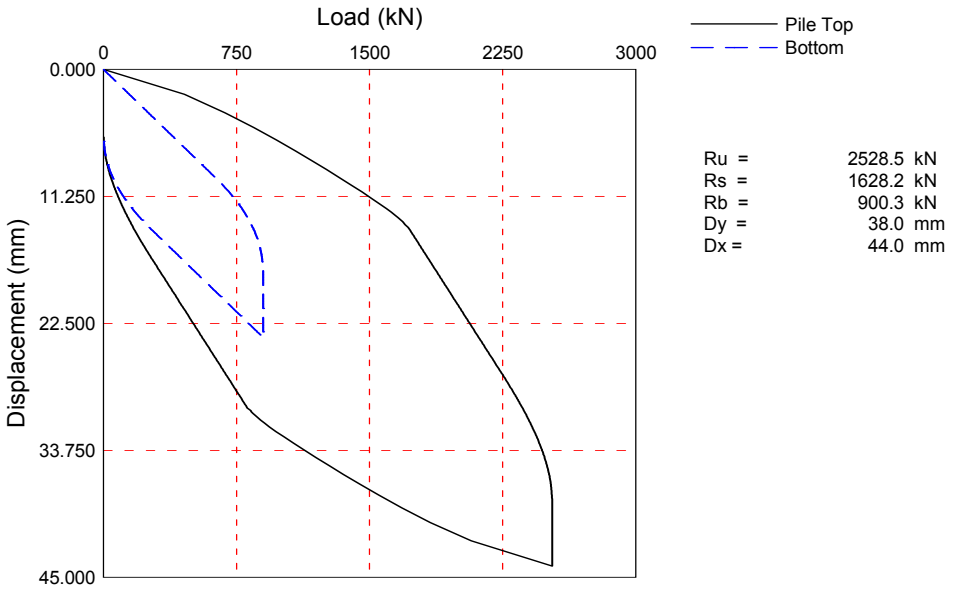
Toe Area 0.090 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.00	871.86	0.00	0.000	0.000	-0.000	0.000	1.200	0.00
2	2.00	842.66	-3.35	0.000	0.000	-0.000	0.000	1.200	0.31
3	3.00	832.66	-4.50	0.000	0.000	-0.000	0.000	1.200	0.32
4	4.00	851.16	-2.37	0.000	0.000	-0.000	0.000	1.200	0.32
5	5.00	859.06	-1.47	0.000	0.000	-0.000	0.000	1.200	0.32
6	6.00	861.26	-1.22	0.000	0.000	-0.000	0.000	1.200	0.32
7	7.00	865.36	-0.75	0.000	0.000	-0.000	0.000	1.200	0.32
8	8.00	871.86	0.00	0.000	0.000	-0.000	0.000	1.200	0.32
9	9.00	896.06	2.78	0.000	0.000	-0.000	0.000	1.200	0.32
10	10.00	914.86	4.93	0.000	0.000	-0.000	0.000	1.200	0.32
11	11.00	909.06	4.27	0.000	0.000	-0.000	0.000	1.200	0.32
12	12.00	784.66	-10.00	0.000	0.000	-0.000	0.000	1.200	0.32
13	13.00	867.76	-0.47	0.000	0.000	-0.000	0.000	1.200	0.32
14	14.00	912.76	4.69	0.000	0.000	-0.000	0.000	1.200	0.32
15	15.00	885.16	1.53	0.000	0.000	-0.000	0.000	1.200	0.32
16	16.00	767.26	-12.00	0.000	0.000	-0.000	0.000	1.200	0.32
17	17.00	926.36	6.25	0.000	0.000	-0.000	0.000	1.200	0.32
18	18.00	923.76	5.95	0.000	0.000	-0.000	0.000	1.200	0.32
19	19.00	871.56	-0.03	0.000	0.000	-0.000	0.000	1.200	0.32
20	20.00	860.96	-1.25	0.000	0.000	-0.000	0.000	1.200	0.32
21	21.00	880.46	0.99	0.000	0.000	-0.000	0.000	1.200	0.32
22	22.00	888.26	1.88	0.000	0.000	-0.000	0.000	1.200	0.32
23	23.00	875.86	0.46	0.000	0.000	-0.000	0.000	1.200	0.32
24	24.00	864.06	-0.89	0.000	0.000	-0.000	0.000	1.200	0.32
25	25.00	864.66	-0.83	0.000	0.000	-0.000	0.000	1.200	0.32
26	26.00	869.26	-0.30	0.000	0.000	-0.000	0.000	1.200	0.32
27	27.00	890.56	2.14	0.000	0.000	-0.000	0.000	1.200	0.32
28	28.00	911.66	4.56	0.000	0.000	-0.000	0.000	1.200	0.32
29	29.00	925.66	6.17	0.000	0.000	-0.000	0.000	1.200	0.32
30	30.00	938.56	7.65	0.000	0.000	-0.000	0.000	1.200	0.32
31	31.00	882.56	1.23	0.000	0.000	-0.000	0.000	1.200	0.32

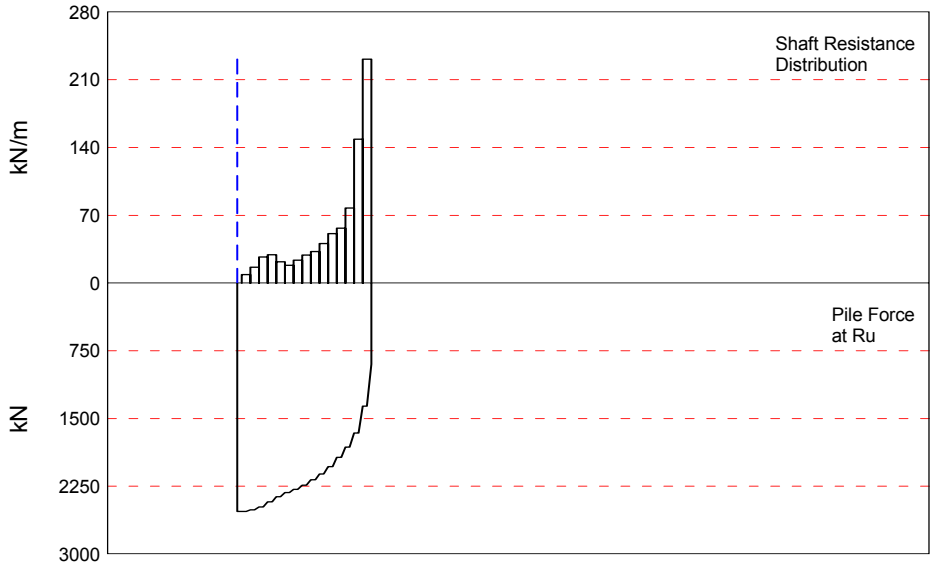
Pile Damping 2.0 %, Time Incr 0.263 ms, Wave Speed 3800.0 m/s, 2L/c 16.3 ms







Ru	=	2528.5 kN
Rs	=	1628.2 kN
Rb	=	900.3 kN
Dy	=	38.0 mm
Dx	=	44.0 mm



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Zatelliitin koepaalutus 14vrk; Pile: ZEB1 14 vrk — Test: 18-Mar-2015 08:27:
Junttan HHK 7A; Blow: 8 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2528.5; along Shaft 1628.2; at Toe 900.3 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				2528.5				
1	3.0	3.0	17.8	2510.7	17.8	5.93	4.94	0.761
2	5.0	5.0	32.9	2477.8	50.7	16.45	13.71	0.761
3	7.0	7.0	53.9	2423.9	104.6	26.95	22.46	0.761
4	9.0	9.0	58.6	2365.3	163.2	29.30	24.42	0.761
5	11.0	11.0	44.2	2321.1	207.4	22.10	18.42	0.761
6	13.0	13.0	37.2	2283.9	244.6	18.60	15.50	0.761
7	15.0	15.0	47.2	2236.7	291.8	23.60	19.67	0.761
8	17.0	17.0	57.9	2178.8	349.7	28.95	24.13	0.761
9	19.0	19.0	65.5	2113.3	415.2	32.75	27.29	0.761
10	21.0	21.0	81.7	2031.6	496.9	40.85	34.04	0.761
11	23.0	23.0	102.4	1929.2	599.3	51.20	42.67	0.761
12	25.0	25.0	113.6	1815.6	712.9	56.80	47.33	0.761
13	27.0	27.0	155.4	1660.2	868.3	77.70	64.75	0.761
14	29.0	29.0	297.1	1363.1	1165.4	148.55	123.79	0.761
15	31.0	31.0	462.8	900.3	1628.2	231.40	192.83	0.761
Avg. Shaft			108.5			52.52	43.77	0.761
Toe			900.3				10003.33	0.033

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	1.004	13.685
Case Damping Factor		1.421	0.034
Unloading Quake	(% of loading quake)	30	95
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Resistance Gap (included in Toe Quake)	(mm)		6.343
Soil Support Dashpot		1.400	0.000
Soil Support Weight	(kN)	12.00	0.00

CAPWAP match quality = 3.08 (Wave Up Match) ; RSA = 0
Observed: final set = 6.000 mm; blow count = 167 b/m
Computed: final set = 8.190 mm; blow count = 122 b/m

max. Top Comp. Stress = 37.1 MPa (T= 21.3 ms, max= 1.009 x Top)
max. Comp. Stress = 37.4 MPa (Z= 3.0 m, T= 21.8 ms)
max. Tens. Stress = -1.42 MPa (Z= 23.0 m, T= 76.1 ms)
max. Energy (EMX) = 61.01 kJ; max. Measured Top Displ. (DMX)=25.45 mm

Zatelliitin koepaalutus 14vrk; Pile: ZEB1 14 vrk — Test: 18-Mar-2015 08:27:
Junttan HHK 7A; Blow: 8 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3334.6	-52.8	37.1	-0.59	61.01	3.5	25.149
2	2.0	3357.5	-56.3	37.3	-0.63	60.73	3.5	24.742
4	4.0	3298.0	-61.8	36.6	-0.69	59.06	3.4	23.958
6	6.0	3210.9	-71.6	35.7	-0.80	56.75	3.2	23.286
8	8.0	3170.9	-75.7	35.2	-0.84	53.42	3.1	22.590
10	10.0	2974.5	-82.3	33.0	-0.91	49.97	3.2	21.857
12	12.0	2949.1	-90.2	32.8	-1.00	47.21	3.0	21.010
14	14.0	2822.7	-99.5	31.4	-1.11	44.89	2.9	20.182
16	16.0	2804.6	-106.5	31.2	-1.18	42.16	2.8	19.247
18	18.0	2725.3	-114.1	30.3	-1.27	39.16	2.7	18.338
20	20.0	2692.8	-119.4	29.9	-1.33	36.06	2.6	17.430
21	21.0	2761.2	-126.9	30.7	-1.41	35.69	2.5	16.980
22	22.0	2629.1	-122.7	29.2	-1.36	32.65	2.4	16.548
23	23.0	2695.1	-128.1	29.9	-1.42	32.35	2.3	16.150
24	24.0	2537.6	-119.6	28.2	-1.33	29.01	2.2	15.803
25	25.0	2627.9	-123.4	29.2	-1.37	28.79	2.2	15.463
26	26.0	2339.1	-110.9	26.0	-1.23	25.35	2.1	15.146
27	27.0	2350.2	-114.0	26.1	-1.27	25.17	2.2	14.838
28	28.0	2103.6	-94.8	23.4	-1.05	20.88	2.1	14.549
29	29.0	2169.4	-96.1	24.1	-1.07	20.72	1.9	14.270
30	30.0	1330.9	-59.3	14.8	-0.66	13.80	2.2	13.997
31	31.0	1210.3	-59.3	13.4	-0.66	3.93	2.3	13.709
Absolute	3.0			37.4			(T =	21.8 ms)
	23.0				-1.42		(T =	76.1 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3946.4	3691.8	3437.1	3182.5	2927.9	2673.2	2418.6	2164.0	1909.3	1654.7
RX	3946.4	3691.8	3437.1	3182.5	2927.9	2673.2	2418.6	2164.0	1909.8	1657.6
RU	3946.4	3691.8	3437.1	3182.5	2927.9	2673.2	2418.6	2164.0	1909.3	1654.7

RAU = 812.0 (kN); RA2 = 1815.0 (kN)

Current CAPWAP Ru = 2528.5 (kN); Corresponding J(RP)= 0.56; J(RX) = 0.56

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
3.70	21.05	3225.6	3267.2	3267.2	25.453	5.997	6.000	61.5	3910.0

PILE PROFILE AND PILE MODEL

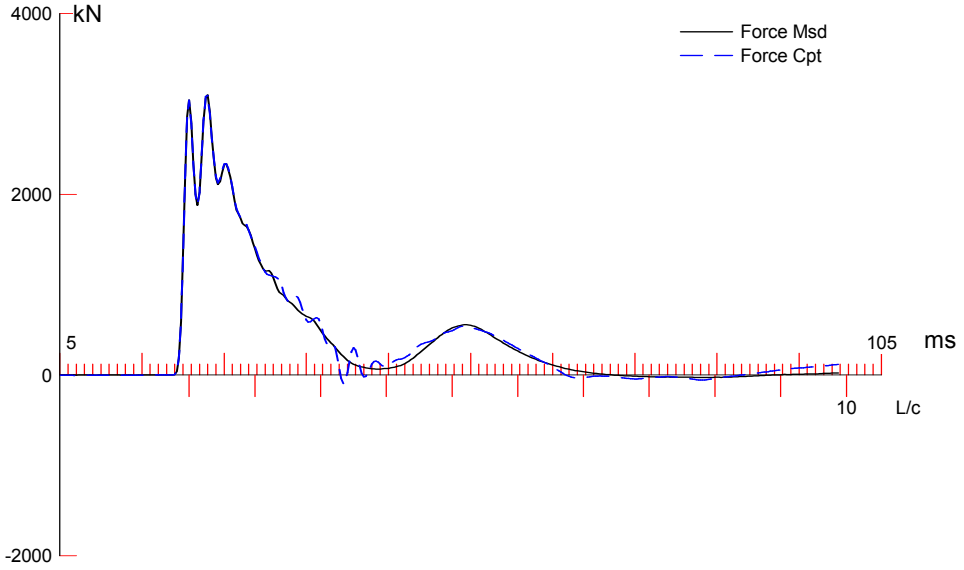
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	900.00	36811.8	25.000	1.200
31.00	900.00	36811.8	25.000	1.200

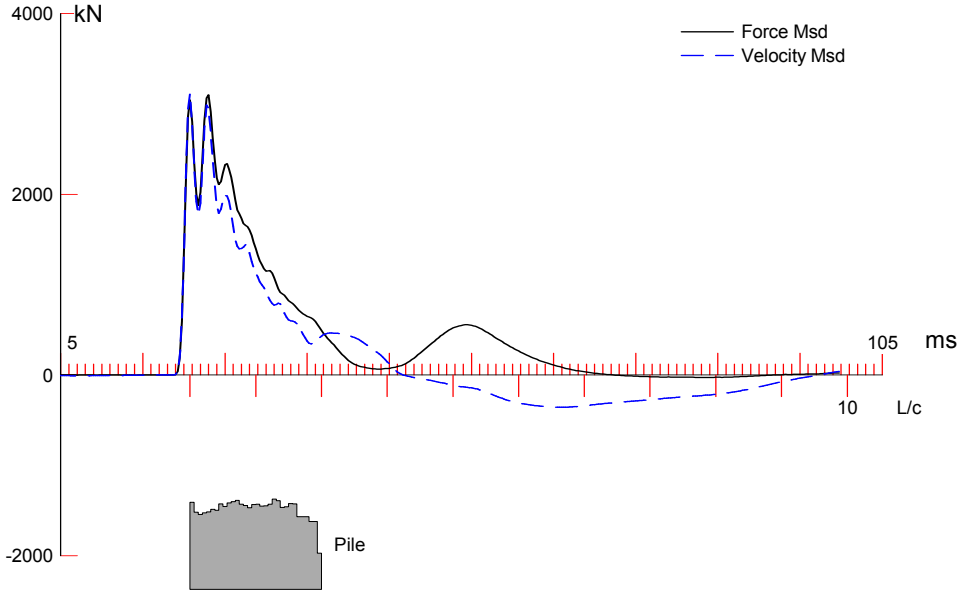
Zatelliitin koepaalutus 14vrk; Pile: ZEB1 14 vrk Test: 18-Mar-2015 08:27:
Junttan HHK 7A; Blow: 8 CAPWAP(R) 2006-2
Inspecta OP: TRe

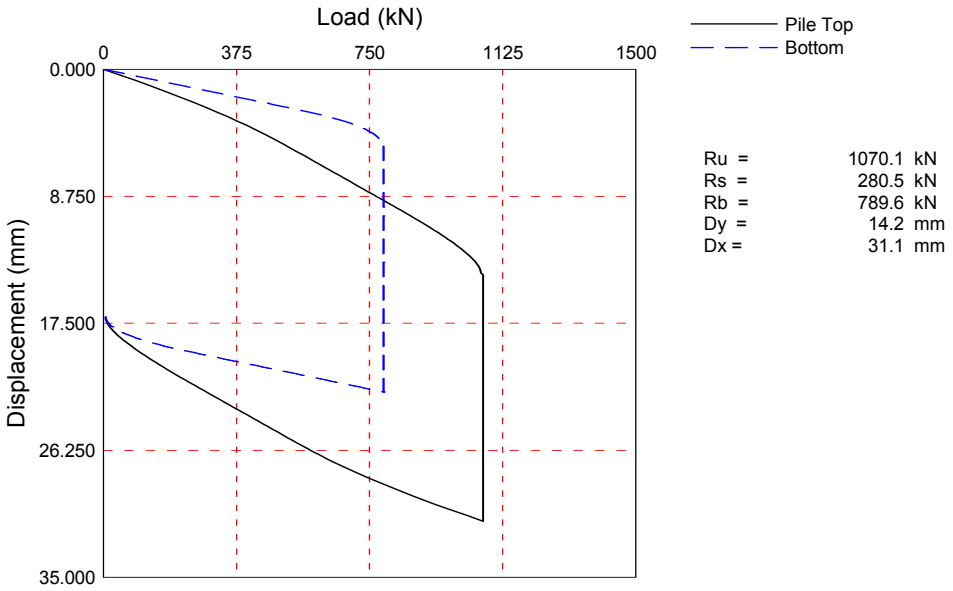
Toe Area 0.090 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.00	871.86	0.00	0.000	0.000	-0.000	0.000	1.200	0.00
2	2.00	847.26	-2.82	0.000	0.000	-0.000	0.000	1.200	0.26
3	3.00	866.96	-0.56	0.000	0.000	-0.000	0.000	1.200	0.26
4	4.00	874.06	0.25	0.000	0.000	-0.000	0.000	1.200	0.26
5	5.00	864.16	-0.88	0.000	0.000	-0.000	0.000	1.200	0.26
6	6.00	860.76	-1.27	0.000	0.000	-0.000	0.000	1.200	0.26
7	7.00	870.76	-0.13	0.000	0.000	-0.000	0.000	1.200	0.26
8	8.00	877.06	0.60	0.000	0.000	-0.000	0.000	1.200	0.26
9	9.00	885.46	1.56	0.000	0.000	-0.000	0.000	1.200	0.26
10	10.00	886.56	1.69	0.000	0.000	-0.000	0.000	1.200	0.26
11	11.00	882.86	1.26	0.000	0.000	-0.000	0.000	1.200	0.26
12	12.00	771.86	-11.47	0.000	0.000	-0.000	0.000	1.200	0.26
13	13.00	879.06	0.83	0.000	0.000	-0.000	0.000	1.200	0.26
14	14.00	892.36	2.35	0.000	0.000	-0.000	0.000	1.200	0.26
15	15.00	791.86	-9.18	0.000	0.000	-0.000	0.000	1.200	0.26
16	16.00	877.76	0.68	0.000	0.000	-0.000	0.000	1.200	0.26
17	17.00	885.56	1.57	0.000	0.000	-0.000	0.000	1.200	0.26
18	18.00	878.36	0.75	0.000	0.000	-0.000	0.000	1.200	0.26
19	19.00	876.26	0.50	0.000	0.000	-0.000	0.000	1.200	0.26
20	20.00	879.46	0.87	0.000	0.000	-0.000	0.000	1.200	0.26
21	21.00	880.16	0.95	0.000	0.000	-0.000	0.000	1.200	0.26
22	22.00	881.36	1.09	0.000	0.000	-0.000	0.000	1.200	0.26
23	23.00	882.86	1.26	0.000	0.000	-0.000	0.000	1.200	0.26
24	24.00	882.96	1.27	0.000	0.000	-0.000	0.000	1.200	0.26
25	25.00	886.26	1.65	0.000	0.000	-0.000	0.000	1.200	0.26
26	26.00	895.06	2.66	0.000	0.000	-0.000	0.000	1.200	0.26
27	27.00	903.56	3.64	0.000	0.000	-0.000	0.000	1.200	0.26
28	28.00	908.86	4.24	0.000	0.000	-0.000	0.000	1.200	0.26
29	29.00	904.36	3.73	0.000	0.000	-0.000	0.000	1.200	0.26
30	30.00	872.46	0.07	0.000	0.000	-0.000	0.000	1.200	0.26
31	31.00	836.26	-4.08	0.000	0.000	-0.000	0.000	1.200	0.26

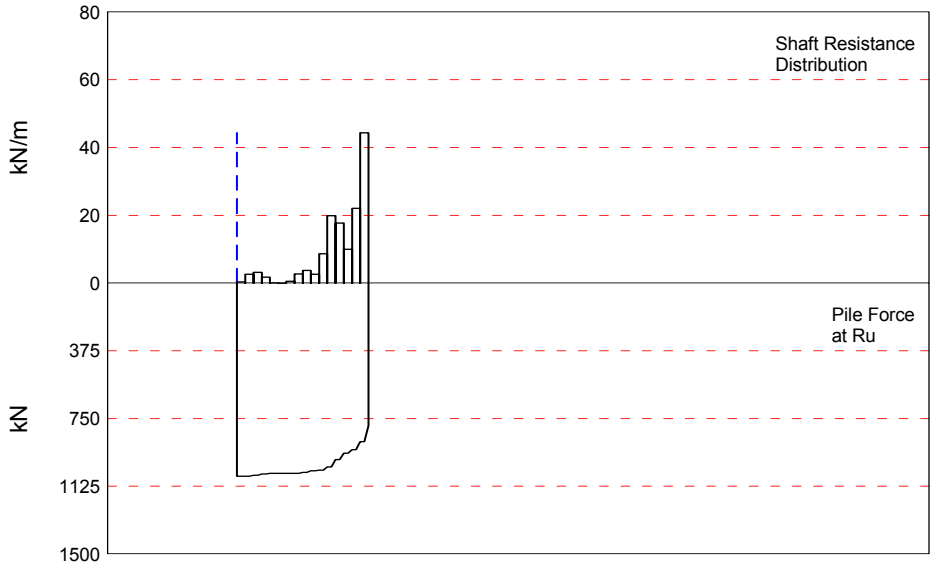
Pile Damping 2.0 %, Time Incr 0.263 ms, Wave Speed 3800.0 m/s, 2L/c 16.3 ms







Ru =	1070.1	kN
Rs =	280.5	kN
Rb =	789.6	kN
Dy =	14.2	mm
Dx =	31.1	mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Koepaalutus Zatelliitti; Pile: ZEB2 Test: 04-Mar-2015 15:47:
Junttan HHK 5A; Blow: 5 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1070.1; along Shaft 280.5; at Toe 789.6 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				1070.1				
1	2.0	2.0	0.7	1069.4	0.7	0.35	0.29	1.474
2	4.0	4.0	5.3	1064.1	6.0	2.65	2.21	1.474
3	6.0	6.0	6.4	1057.7	12.4	3.20	2.67	1.474
4	8.0	8.0	3.6	1054.1	16.0	1.80	1.50	1.474
5	10.0	10.0	0.1	1054.0	16.1	0.05	0.04	1.474
6	12.0	12.0	0.0	1054.0	16.1	0.00	0.00	0.000
7	14.0	14.0	1.1	1052.9	17.2	0.55	0.46	1.474
8	16.0	16.0	5.4	1047.5	22.6	2.70	2.25	1.474
9	18.0	18.0	7.4	1040.1	30.0	3.70	3.08	1.474
10	20.0	20.0	5.2	1034.9	35.2	2.60	2.17	1.474
11	22.0	22.0	17.3	1017.6	52.5	8.65	7.21	1.474
12	24.0	24.0	39.7	977.9	92.2	19.85	16.54	1.474
13	26.0	26.0	35.5	942.4	127.7	17.75	14.79	1.474
14	28.0	28.0	19.9	922.5	147.6	9.95	8.29	1.474
15	30.0	30.0	44.1	878.4	191.7	22.05	18.37	1.474
16	32.0	32.0	88.8	789.6	280.5	44.40	37.00	1.474
Avg. Shaft			17.5			8.77	7.30	1.474
Toe			789.6				8773.33	0.307

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	1.004	4.007
Case Damping Factor		0.451	0.264
Damping Type		Smith	
Unloading Quake	(% of loading quake)	30	100
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	1	
Soil Plug Weight	(kN)		2.26
Soil Support Dashpot		0.200	4.349
Soil Support Weight	(kN)	12.00	12.00

CAPWAP match quality = 2.65 (Wave Up Match) ; RSA = 0
Observed: final set = 17.000 mm; blow count = 59 b/m
Computed: final set = 20.047 mm; blow count = 50 b/m

max. Top Comp. Stress = 34.8 MPa (T= 23.5 ms, max= 1.037 x Top)
max. Comp. Stress = 36.1 MPa (Z= 6.0 m, T= 24.8 ms)
max. Tens. Stress = -1.54 MPa (Z= 32.0 m, T= 28.8 ms)
max. Energy (EMX) = 49.81 kJ; max. Measured Top Displ. (DMX)=28.21 mm

Koepaalutus Zatelliitti; Pile: ZEB2 Test: 04-Mar-2015 15:47:
Junttan HHK 5A; Blow: 5 CAPWAP(R) 2006-2
Inspecta OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3133.1	-69.3	34.8	-0.77	49.81	3.3	27.941
2	2.0	3156.1	-59.3	35.1	-0.66	49.79	3.3	27.883
4	4.0	3221.1	-62.6	35.8	-0.70	49.67	3.2	27.741
6	6.0	3249.8	-65.6	36.1	-0.73	49.12	3.1	27.582
8	8.0	3179.0	-68.9	35.3	-0.77	48.50	3.1	27.409
10	10.0	3199.6	-74.0	35.6	-0.82	48.10	3.1	27.209
12	12.0	3168.2	-79.3	35.2	-0.88	48.03	3.0	26.985
14	14.0	3140.6	-83.3	34.9	-0.93	47.94	3.1	26.719
16	16.0	3229.2	-84.7	35.9	-0.94	47.74	3.0	26.437
18	18.0	3115.0	-85.8	34.6	-0.95	47.17	3.0	26.156
20	20.0	3234.7	-85.7	35.9	-0.95	46.40	2.9	25.846
22	22.0	3059.5	-87.4	34.0	-0.97	45.84	3.0	25.534
23	23.0	3017.7	-87.2	33.5	-0.97	44.28	2.9	25.364
24	24.0	3070.8	-87.4	34.1	-0.97	44.22	2.9	25.190
25	25.0	2850.7	-88.0	31.7	-0.98	41.03	3.0	25.014
26	26.0	2755.3	-90.4	30.6	-1.00	40.97	3.2	24.829
27	27.0	2585.7	-96.4	28.7	-1.07	37.98	3.1	24.604
28	28.0	2599.9	-99.8	28.9	-1.11	37.89	3.2	24.380
29	29.0	2471.0	-94.1	27.5	-1.05	36.12	3.6	24.167
30	30.0	2225.3	-106.8	24.7	-1.19	36.05	3.7	23.937
31	31.0	2259.1	-76.5	25.1	-0.85	32.40	3.2	23.703
32	32.0	2292.8	-138.9	25.5	-1.54	26.53	3.7	23.267
Absolute	6.0			36.1			(T =	24.8 ms)
	32.0				-1.54		(T =	28.8 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3186.1	2875.8	2565.5	2255.2	1944.9	1634.6	1324.3	1014.1	703.8	393.5
RX	3186.1	2875.8	2565.5	2255.2	1944.9	1634.6	1324.3	1014.1	703.8	696.7
RU	3186.1	2875.8	2565.5	2255.2	1944.9	1634.6	1324.3	1014.1	703.8	393.5

RAU = 691.6 (kN); RA2 = 757.6 (kN)

Current CAPWAP Ru = 1070.1 (kN); Corresponding J(RP)= 0.68; J(RX) = 0.68

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
3.47	21.00	3188.4	3100.6	3138.4	28.209	17.002	17.000	50.3	2224.7

PILE PROFILE AND PILE MODEL

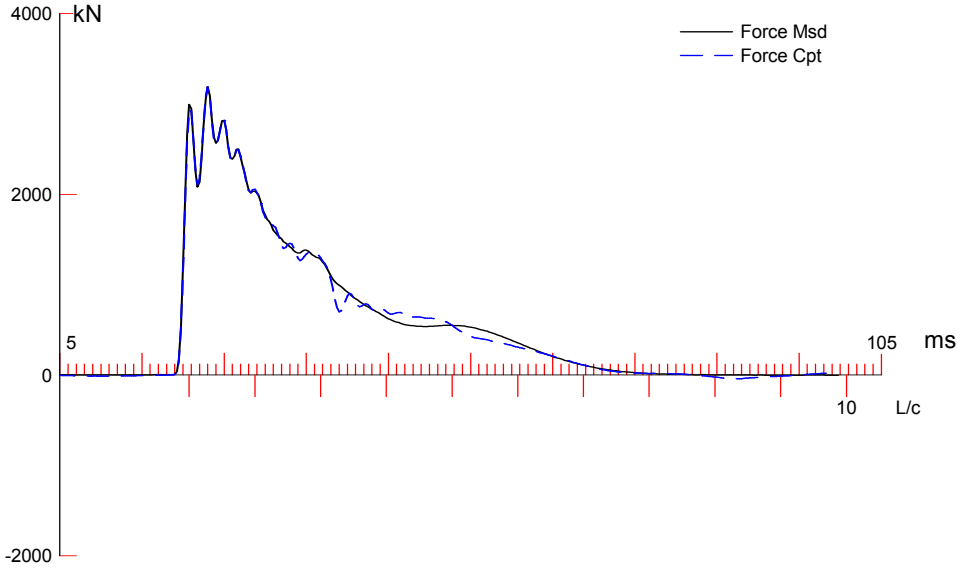
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	900.00	40788.6	25.000	1.200
32.00	900.00	40788.6	25.000	1.200

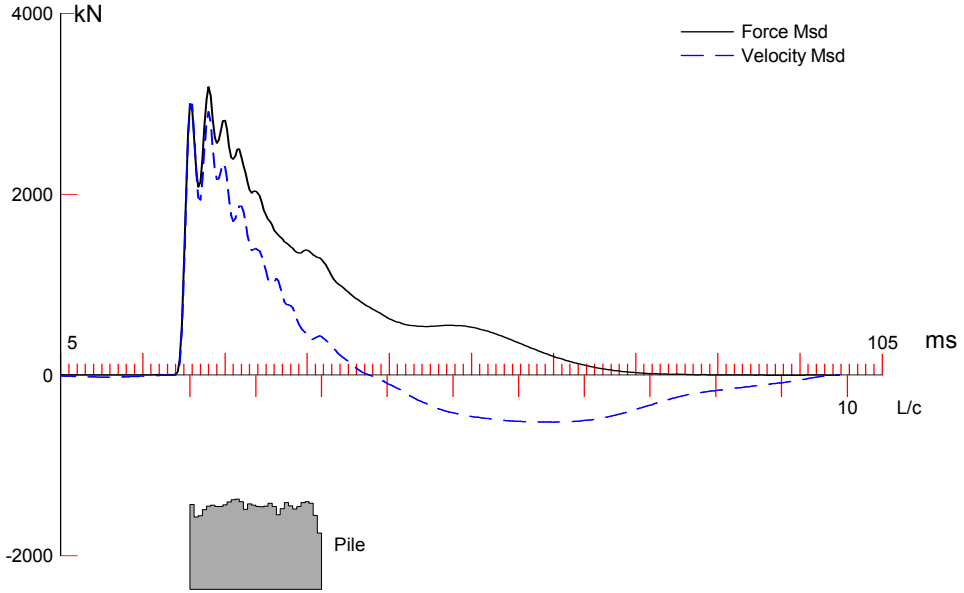
Koepaalutus Zatelliitti; Pile: ZEB2 Test: 04-Mar-2015 15:47:
Junttan HHK 5A; Blow: 5 CAPWAP(R) 2006-2
Inspecta OP: TRe

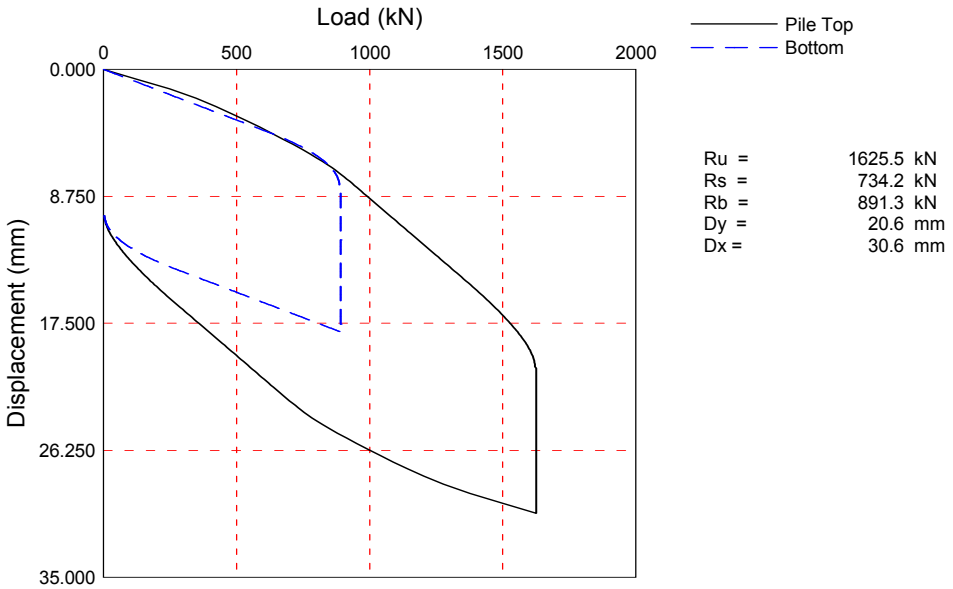
Toe Area 0.090 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.00	917.74	0.00	0.000	0.000	-0.000	0.000	1.200	0.00
2	2.00	815.04	-11.19	0.000	0.000	-0.000	0.000	1.200	0.34
3	3.00	790.34	-13.88	0.000	0.000	-0.000	0.000	1.200	0.36
4	4.00	808.14	-11.94	0.000	0.000	-0.000	0.000	1.200	0.36
5	5.00	816.44	-11.04	0.000	0.000	-0.000	0.000	1.200	0.36
6	6.00	844.24	-8.01	0.000	0.000	-0.000	0.000	1.200	0.36
7	7.00	834.54	-9.07	0.000	0.000	-0.000	0.000	1.200	0.36
8	8.00	901.34	-1.79	0.000	0.000	-0.000	0.000	1.200	0.36
9	9.00	873.94	-4.77	0.000	0.000	-0.000	0.000	1.200	0.36
10	10.00	910.84	-0.75	0.000	0.000	-0.000	0.000	1.200	0.36
11	11.00	926.74	0.98	0.000	0.000	-0.000	0.000	1.200	0.36
12	12.00	939.24	2.34	0.000	0.000	-0.000	0.000	1.200	0.36
13	13.00	897.74	-2.18	0.000	0.000	-0.000	0.000	1.200	0.36
14	14.00	886.74	-3.38	0.000	0.000	-0.000	0.000	1.200	0.36
15	15.00	860.54	-6.23	0.000	0.000	-0.000	0.000	1.200	0.36
16	16.00	894.04	-2.58	0.000	0.000	-0.000	0.000	1.200	0.36
17	17.00	898.14	-2.14	0.000	0.000	-0.000	0.000	1.200	0.36
18	18.00	877.44	-4.39	0.000	0.000	-0.000	0.000	1.200	0.36
19	19.00	881.14	-3.99	0.000	0.000	-0.000	0.000	1.200	0.36
20	20.00	900.34	-1.90	0.000	0.000	-0.000	0.000	1.200	0.36
21	21.00	952.34	3.77	0.000	0.000	-0.000	0.000	1.200	0.36
22	22.00	936.54	2.05	0.000	0.000	-0.000	0.000	1.200	0.36
23	23.00	864.94	-5.75	0.000	0.000	-0.000	0.000	1.200	0.36
24	24.00	871.44	-5.04	0.000	0.000	-0.000	0.000	1.200	0.36
25	25.00	905.14	-1.37	0.000	0.000	-0.000	0.000	1.200	0.36
26	26.00	903.24	-1.58	0.000	0.000	-0.000	0.000	1.200	0.36
27	27.00	767.74	-16.34	0.000	0.000	-0.000	0.000	1.200	0.36
30	30.00	717.74	-21.79	0.000	0.000	-0.000	0.000	1.200	0.36
32	32.00	383.04	-58.26	0.000	0.000	-0.000	0.000	1.200	0.36

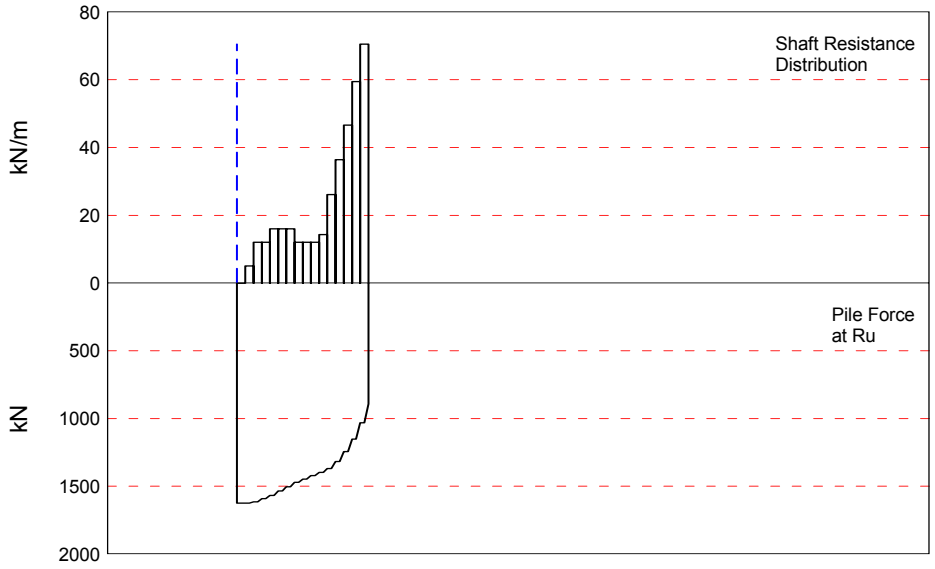
Pile Damping 2.0 %, Time Incr 0.250 ms, Wave Speed 4000.0 m/s, 2L/c 16.0 ms







Ru	=	1625.5 kN
Rs	=	734.2 kN
Rb	=	891.3 kN
Dy	=	20.6 mm
Dx	=	30.6 mm



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Zatelliitin koepaalutus 14vrk; Pile: ZEB2 14 vrk Test: 18-Mar-2015 08:12:
Junttan HHK 7A; Blow: 8 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1625.5; along Shaft 734.2; at Toe 891.3 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				1625.5				
1	2.0	2.0	0.0	1625.5	0.0	0.00	0.00	0.000
2	4.0	4.0	10.2	1615.3	10.2	5.10	4.25	0.652
3	6.0	6.0	24.1	1591.2	34.3	12.05	10.04	0.652
4	8.0	8.0	24.1	1567.1	58.4	12.05	10.04	0.652
5	10.0	10.0	32.1	1535.0	90.5	16.05	13.37	0.652
6	12.0	12.0	32.1	1502.9	122.6	16.05	13.37	0.652
7	14.0	14.0	32.1	1470.8	154.7	16.05	13.37	0.652
8	16.0	16.0	24.1	1446.7	178.8	12.05	10.04	0.652
9	18.0	18.0	24.1	1422.6	202.9	12.05	10.04	0.652
10	20.0	20.0	24.1	1398.5	227.0	12.05	10.04	0.652
11	22.0	22.0	28.7	1369.8	255.7	14.35	11.96	0.652
12	24.0	24.0	52.3	1317.5	308.0	26.15	21.79	0.652
13	26.0	26.0	72.9	1244.6	380.9	36.45	30.37	0.652
14	28.0	28.0	93.2	1151.4	474.1	46.60	38.83	0.652
15	30.0	30.0	119.0	1032.4	593.1	59.50	49.58	0.652
16	32.0	32.0	141.1	891.3	734.2	70.55	58.79	0.652
Avg. Shaft			45.9			22.94	19.12	0.652
Toe			891.3				9903.33	0.379

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	1.004	6.228
Case Damping Factor		0.522	0.368
Unloading Quake	(% of loading quake)	47	100
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Soil Plug Weight	(kN)		1.63
Soil Support Dashpot		0.500	0.000
Soil Support Weight	(kN)	12.00	0.00

CAPWAP match quality = 2.60 (Wave Up Match) ; RSA = 0
Observed: final set = 10.000 mm; blow count = 100 b/m
Computed: final set = 16.600 mm; blow count = 60 b/m

max. Top Comp. Stress = 35.4 MPa (T= 23.5 ms, max= 1.050 x Top)
max. Comp. Stress = 37.2 MPa (Z= 6.0 m, T= 25.0 ms)
max. Tens. Stress = -1.47 MPa (Z= 24.0 m, T= 81.0 ms)
max. Energy (EMX) = 64.62 kJ; max. Measured Top Displ. (DMX)=28.36 mm

Zatelliitin koepaalutus 14vrk; Pile: ZEB2 14 vrk — Test: 18-Mar-2015 08:12:
Junttan HHK 7A; Blow: 8 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3189.3	-46.0	35.4	-0.51	64.62	3.3	28.882
2	2.0	3208.2	-47.6	35.6	-0.53	64.51	3.2	28.639
4	4.0	3303.3	-54.5	36.7	-0.61	64.24	3.1	28.149
6	6.0	3349.4	-60.5	37.2	-0.67	63.35	3.1	27.668
8	8.0	3247.9	-65.8	36.1	-0.73	61.68	3.0	27.191
10	10.0	3270.2	-71.1	36.3	-0.79	60.04	2.9	26.705
12	12.0	3141.5	-80.5	34.9	-0.89	57.98	2.9	26.211
14	14.0	3126.9	-90.4	34.7	-1.00	55.93	2.8	25.677
16	16.0	2974.4	-101.0	33.0	-1.12	53.92	2.9	25.133
18	18.0	3019.1	-110.8	33.5	-1.23	52.31	2.7	24.549
20	20.0	2953.6	-119.9	32.8	-1.33	50.73	2.8	23.962
22	22.0	3032.2	-127.0	33.7	-1.41	49.13	2.6	23.311
23	23.0	3033.3	-127.7	33.7	-1.42	47.56	2.6	22.988
24	24.0	3053.9	-132.5	33.9	-1.47	47.37	2.6	22.687
25	25.0	2853.5	-129.7	31.7	-1.44	44.85	2.6	22.387
26	26.0	2797.2	-131.8	31.1	-1.46	44.66	2.6	22.075
27	27.0	2642.4	-124.1	29.4	-1.38	41.41	2.6	21.815
28	28.0	2685.2	-125.1	29.8	-1.39	41.29	2.8	21.584
29	29.0	2373.2	-113.9	26.4	-1.27	37.39	3.0	21.354
30	30.0	2309.9	-114.0	25.7	-1.27	37.26	2.8	21.116
31	31.0	2214.7	-98.2	24.6	-1.09	32.53	2.5	20.837
32	32.0	2197.6	-96.9	24.4	-1.08	27.37	3.0	20.468
Absolute	6.0			37.2			(T =	25.0 ms)
	24.0				-1.47		(T =	81.0 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3503.9	3238.5	2973.1	2707.7	2442.3	2176.9	1911.5	1646.1	1380.7	1115.3
RX	3503.9	3238.5	2973.1	2707.7	2442.3	2176.9	1911.5	1646.1	1380.7	1115.3
RU	3503.9	3238.5	2973.1	2707.7	2442.3	2176.9	1911.5	1646.1	1380.7	1115.3

RAU = 971.1 (kN); RA2 = 1489.2 (kN)

Current CAPWAP Ru = 1625.5 (kN); Corresponding J(RP)= 0.71; J(RX) = 0.71

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
3.37	21.00	3095.1	3062.8	3216.9	28.359	9.999	10.000	64.6	3367.7

PILE PROFILE AND PILE MODEL

Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	900.00	40788.6	25.000	1.200
32.00	900.00	40788.6	25.000	1.200

Zatelliitin koepaalutus 14vrk; Pile: ZEB2 14 vrk Test: 18-Mar-2015 08:12:
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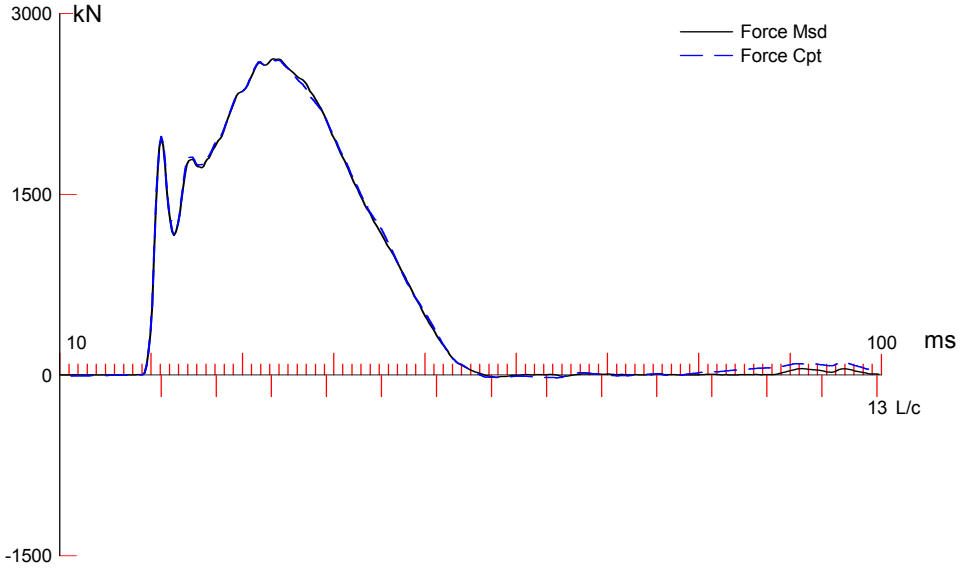
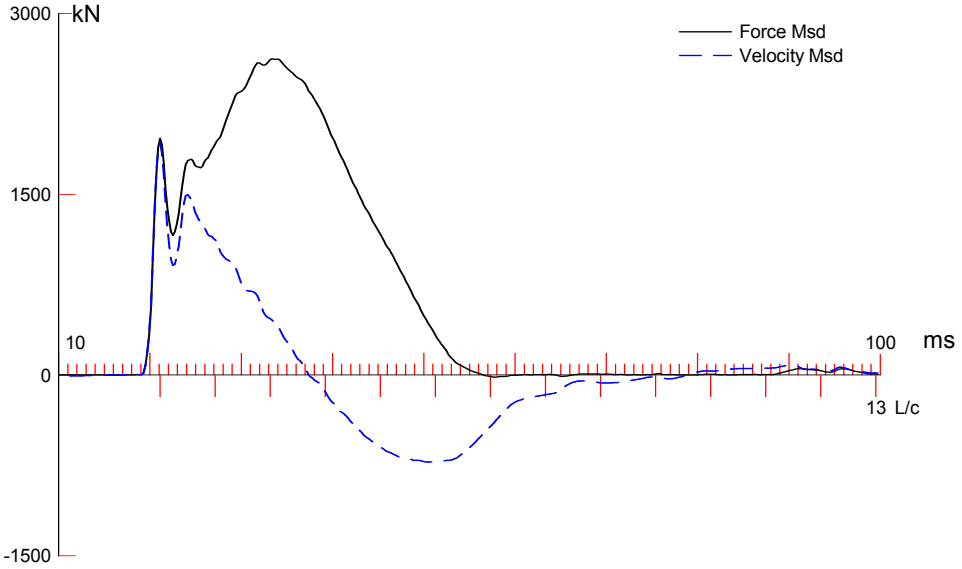
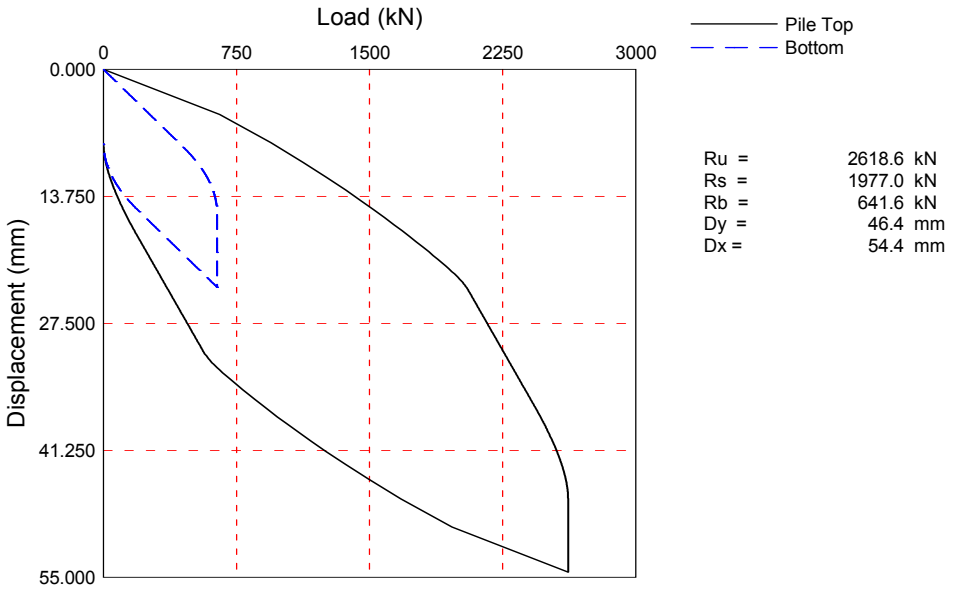
Toe Area 0.090 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.00	917.74	0.00	0.000	0.000	-0.000	0.000	1.200	0.00
2	2.00	784.24	-14.55	0.000	0.000	-0.000	0.000	1.200	0.31
3	3.00	796.14	-13.25	0.000	0.000	-0.000	0.000	1.200	0.31
4	4.00	863.54	-5.91	0.000	0.000	-0.000	0.000	1.200	0.31
5	5.00	900.24	-1.91	0.000	0.000	-0.000	0.000	1.200	0.31
6	6.00	910.74	-0.76	0.000	0.000	-0.000	0.000	1.200	0.31
7	7.00	897.54	-2.20	0.000	0.000	-0.000	0.000	1.200	0.31
8	8.00	898.34	-2.11	0.000	0.000	-0.000	0.000	1.200	0.31
9	9.00	914.04	-0.40	0.000	0.000	-0.000	0.000	1.200	0.31
10	10.00	944.44	2.91	0.000	0.000	-0.000	0.000	1.200	0.31
11	11.00	970.94	5.80	0.000	0.000	-0.000	0.000	1.200	0.31
12	12.00	976.04	6.35	0.000	0.000	-0.000	0.000	1.200	0.31
13	13.00	948.64	3.37	0.000	0.000	-0.000	0.000	1.200	0.31
14	14.00	867.34	-5.49	0.000	0.000	-0.000	0.000	1.200	0.31
15	15.00	923.64	0.64	0.000	0.000	-0.000	0.000	1.200	0.31
16	16.00	911.44	-0.69	0.000	0.000	-0.000	0.000	1.200	0.31
17	17.00	895.24	-2.45	0.000	0.000	-0.000	0.000	1.200	0.31
18	18.00	893.54	-2.64	0.000	0.000	-0.000	0.000	1.200	0.31
19	19.00	899.24	-2.02	0.000	0.000	-0.000	0.000	1.200	0.31
20	20.00	932.04	1.56	0.000	0.000	-0.000	0.000	1.200	0.31
21	21.00	896.34	-2.33	0.000	0.000	-0.000	0.000	1.200	0.31
22	22.00	807.14	-12.05	0.000	0.000	-0.000	0.000	1.200	0.31
23	23.00	872.24	-4.96	0.000	0.000	-0.000	0.000	1.200	0.31
24	24.00	937.94	2.20	0.000	0.000	-0.000	0.000	1.200	0.31
25	25.00	904.04	-1.49	0.000	0.000	-0.000	0.000	1.200	0.31
26	26.00	868.44	-5.37	0.000	0.000	-0.000	0.000	1.200	0.31
27	27.00	897.74	-2.18	0.000	0.000	-0.000	0.000	1.200	0.31
28	28.00	939.24	2.34	0.000	0.000	-0.000	0.000	1.200	0.31
29	29.00	950.04	3.52	0.000	0.000	-0.000	0.000	1.200	0.31
30	30.00	930.84	1.43	0.000	0.000	-0.000	0.000	1.200	0.31
31	31.00	800.94	-12.73	0.000	0.000	-0.000	0.000	1.200	0.31
32	32.00	608.04	-33.75	0.000	0.000	-0.000	0.000	1.200	0.31

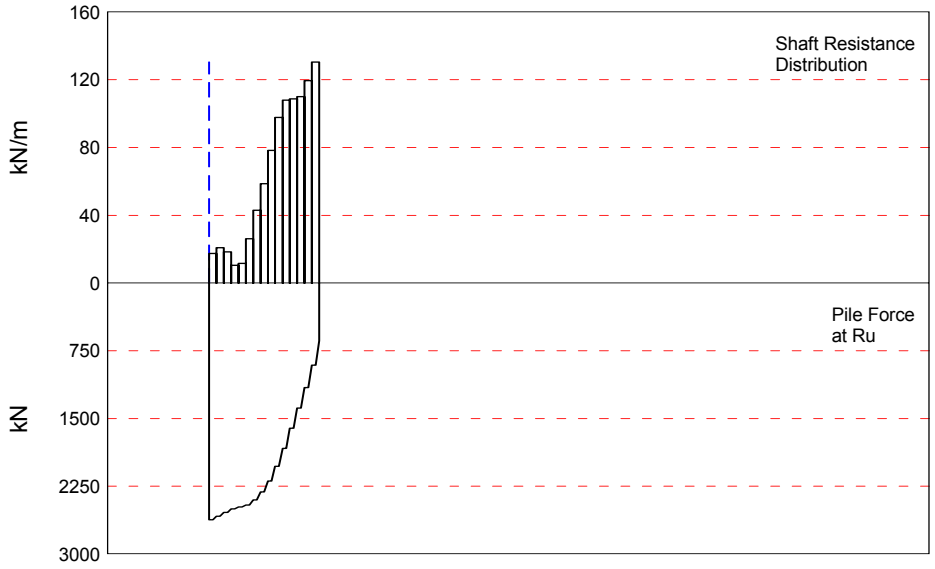
Pile Damping 2.0 %, Time Incr 0.250 ms, Wave Speed 4000.0 m/s, 2L/c 16.0 ms







Ru = 2618.6 kN
Rs = 1977.0 kN
Rb = 641.6 kN
Dy = 46.4 mm
Dx = 54.4 mm



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Zatelliitin koepaalutus 14vrk; Pile: ZET1 14 vrk — Test: 18-Mar-2015 11:54:
Junttan HHK 7A; Blow: 50 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2618.6; along Shaft 1977.0; at Toe 641.6 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				2618.6				
1	2.1	2.1	36.0	2582.6	36.0	17.48	17.17	0.386
2	4.1	4.1	43.0	2539.6	79.0	20.87	20.51	0.386
3	6.2	6.2	38.1	2501.5	117.1	18.50	18.18	0.386
4	8.2	8.2	21.8	2479.7	138.9	10.58	10.40	0.386
5	10.3	10.3	24.1	2455.6	163.0	11.70	11.50	0.386
6	12.4	12.4	54.1	2401.5	217.1	26.26	25.81	0.386
7	14.4	14.4	88.7	2312.8	305.8	43.06	42.32	0.386
8	16.5	16.5	121.0	2191.8	426.8	58.74	57.72	0.386
9	18.5	18.5	161.1	2030.7	587.9	78.20	76.85	0.386
10	20.6	20.6	201.4	1829.3	789.3	97.77	96.08	0.386
11	22.7	22.7	222.4	1606.9	1011.7	107.96	106.10	0.386
12	24.7	24.7	223.8	1383.1	1235.5	108.64	106.77	0.386
13	26.8	26.8	226.6	1156.5	1462.1	110.00	108.10	0.386
14	28.8	28.8	246.1	910.4	1708.2	119.47	117.40	0.386
15	30.9	30.9	268.8	641.6	1977.0	130.49	128.23	0.386
Avg. Shaft			131.8			63.98	62.88	0.386
Toe			641.6				7786.68	0.371

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	1.004	12.000
Case Damping Factor		1.887	0.589
Unloading Quake	(% of loading quake)	35	214
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	1	
Resistance Gap (included in Toe Quake)	(mm)		8.622
Soil Plug Weight	(kN)		0.21
Soil Support Dashpot		4.446	0.000
Soil Support Weight	(kN)	10.48	0.00

CAPWAP match quality = 0.97 (Wave Up Match) ; RSA = 0
Observed: final set = 8.000 mm; blow count = 125 b/m
Computed: final set = 8.344 mm; blow count = 120 b/m

max. Top Comp. Stress = 266.7 MPa (T= 33.8 ms, max= 1.010 x Top)
max. Comp. Stress = 269.5 MPa (Z= 2.1 m, T= 32.4 ms)
max. Tens. Stress = -12.12 MPa (Z= 12.4 m, T= 58.1 ms)
max. Energy (EMX) = 69.90 kJ; max. Measured Top Displ. (DMX)=37.07 mm

Zatelliitin koepaalutus 14vrk; Pile: ZET1 14 vrk — Test: 18-Mar-2015 11:54:
Junttan HHK 7A; Blow: 50 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2630.1	-40.1	266.7	-4.07	69.90	4.6	36.024
2	2.1	2657.2	-57.4	269.5	-5.82	68.61	4.6	34.886
4	4.1	2641.0	-75.9	267.8	-7.70	63.67	4.4	32.651
6	6.2	2617.5	-90.4	265.4	-9.17	58.64	4.3	30.469
8	8.2	2593.5	-99.4	263.0	-10.08	54.27	4.2	28.350
10	10.3	2571.1	-110.2	260.7	-11.17	51.04	4.1	26.296
12	12.4	2540.8	-119.5	257.7	-12.12	47.98	3.9	24.317
14	14.4	2472.4	-117.2	250.7	-11.88	44.03	3.6	22.411
16	16.5	2360.7	-103.5	239.4	-10.49	39.28	3.3	20.555
18	18.5	2205.6	-80.1	223.7	-8.12	34.17	2.9	18.788
19	19.6	1997.6	-41.9	202.6	-4.25	29.49	2.7	17.991
20	20.6	2000.5	-48.1	202.9	-4.88	28.95	2.4	17.256
21	21.6	1748.5	-4.5	177.3	-0.46	24.15	2.2	16.569
22	22.7	1750.8	-11.0	177.5	-1.12	23.67	2.0	15.876
23	23.7	1472.7	-1.0	149.3	-0.10	19.10	1.8	15.251
24	24.7	1472.8	-1.1	149.3	-0.11	18.74	1.6	14.661
25	25.8	1192.2	-1.1	120.9	-0.12	14.73	1.5	14.156
26	26.8	1204.7	-1.5	122.2	-0.15	14.47	1.3	13.649
27	27.8	999.3	-1.4	101.3	-0.15	10.83	1.2	13.201
28	28.8	1013.9	-1.8	102.8	-0.18	10.64	1.1	12.772
29	29.9	806.5	-1.4	81.8	-0.15	7.12	1.1	12.408
30	30.9	811.6	-1.9	82.3	-0.19	3.31	1.0	12.043
Absolute	2.1			269.5			(T =	32.4 ms)
	12.4				-12.12		(T =	58.1 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3031.0	2942.4	2853.8	2765.1	2676.5	2587.9	2499.3	2410.6	2322.0	2233.4
RX	3038.7	2950.6	2862.5	2774.4	2686.2	2598.1	2529.6	2484.5	2439.4	2396.7
RU	3031.0	2942.4	2853.8	2765.1	2676.5	2587.9	2499.3	2410.6	2322.0	2233.4

RAU = 2214.6 (kN); RA2 = 2375.3 (kN)

Current CAPWAP Ru = 2618.6 (kN); Corresponding J(RP)= 0.47; J(RX) = 0.48

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
4.82	21.32	1947.5	1969.8	2627.5	37.074	7.990	8.000	71.0	3148.6

PILE PROFILE AND PILE MODEL

Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
30.90	98.61	210000.0	78.500	1.018

Zatelliitin koepaalutus 14vrk; Pile: ZET1 14 vrk Test: 18-Mar-2015 11:54:
Junttan HHK 7A; Blow: 50 CAPWAP(R) 2006-2
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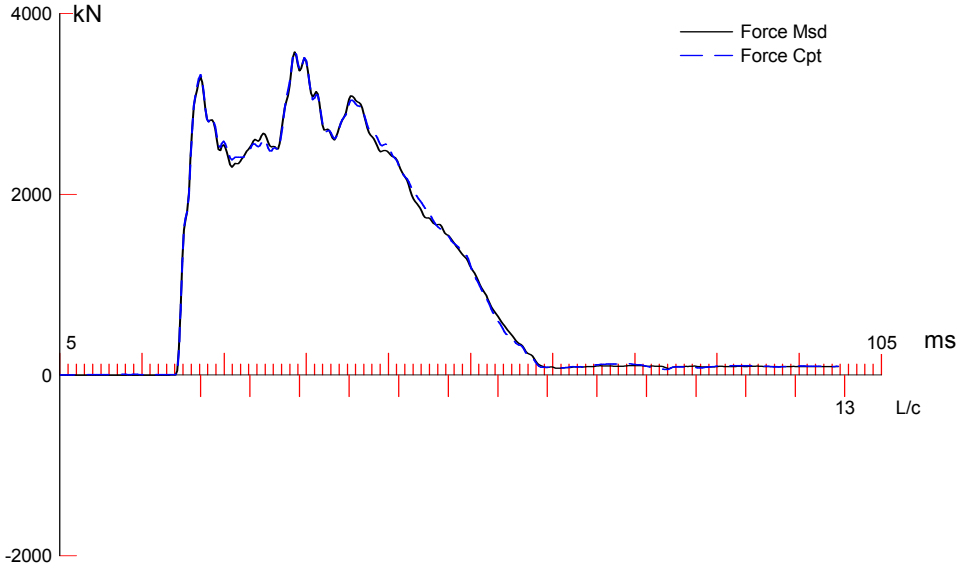
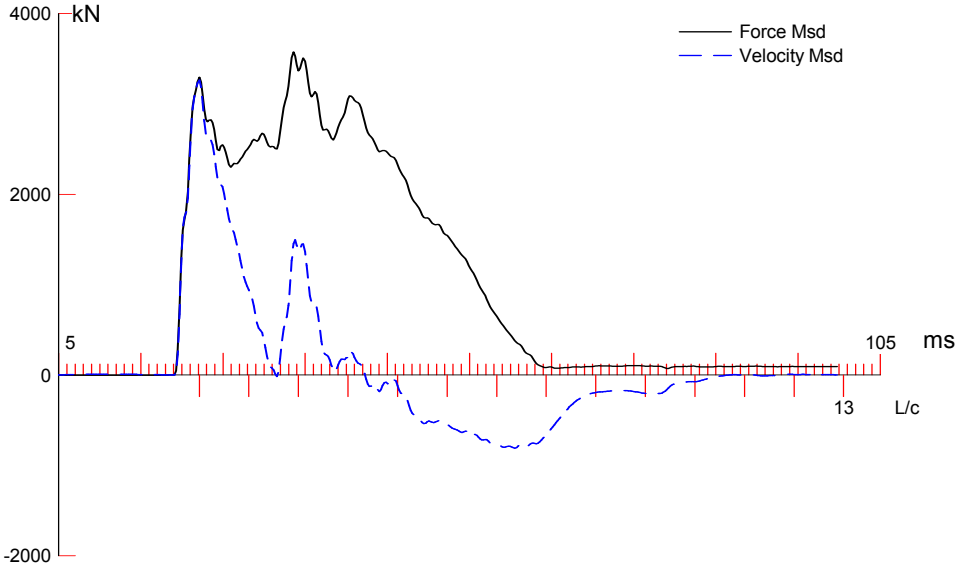
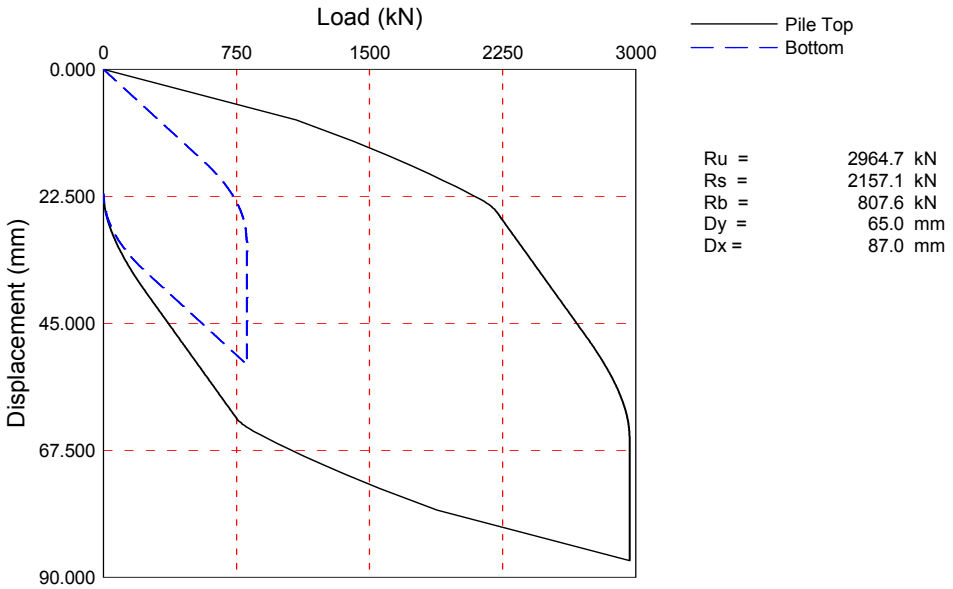
Toe Area 0.082 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.03	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.06	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.01
3	3.09	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02
30	30.90	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02

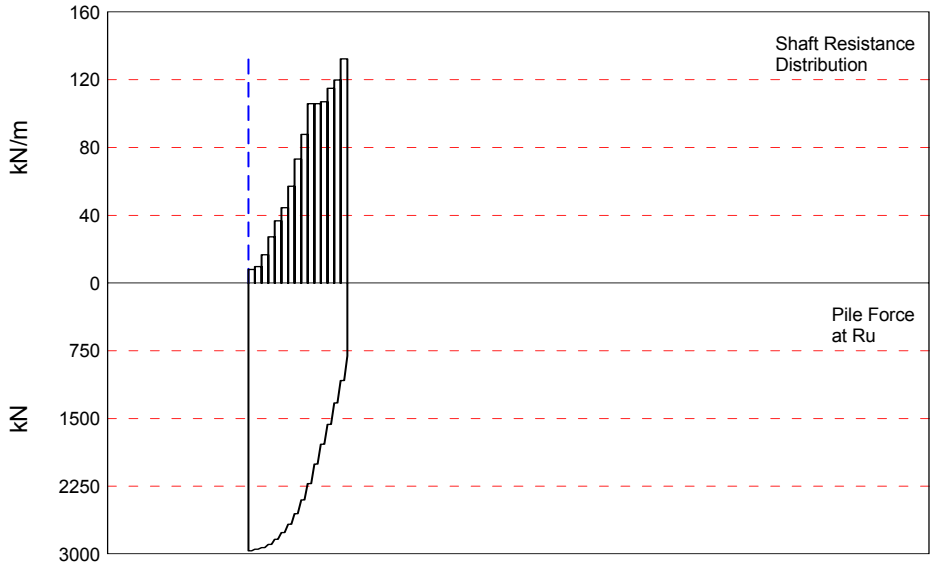
Pile Damping 1.0 %, Time Incr 0.201 ms, Wave Speed 5121.9 m/s, 2L/c 12.1 ms







Ru = 2964.7 kN
Rs = 2157.1 kN
Rb = 807.6 kN
Dy = 65.0 mm
Dx = 87.0 mm



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Zatelliitin koepaalutus; Pile: ZET1 Test: 31-Mar-2015 15:15:
Vapaapudotusjarkale 9t; Blow: 25 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2964.7; along Shaft 2157.1; at Toe 807.6 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				2964.7				
1	2.1	2.1	16.5	2948.2	16.5	8.01	7.87	0.186
2	4.1	4.1	20.1	2928.1	36.6	9.76	9.59	0.186
3	6.2	6.2	34.4	2893.7	71.0	16.70	16.41	0.186
4	8.2	8.2	56.5	2837.2	127.5	27.43	26.95	0.186
5	10.3	10.3	75.7	2761.5	203.2	36.75	36.11	0.186
6	12.4	12.4	91.7	2669.8	294.9	44.51	43.75	0.186
7	14.4	14.4	117.7	2552.1	412.6	57.14	56.15	0.186
8	16.5	16.5	150.7	2401.4	563.3	73.16	71.89	0.186
9	18.5	18.5	180.9	2220.5	744.2	87.82	86.30	0.186
10	20.6	20.6	218.1	2002.4	962.3	105.87	104.05	0.186
11	22.7	22.7	218.1	1784.3	1180.4	105.87	104.05	0.186
12	24.7	24.7	220.5	1563.8	1400.9	107.04	105.19	0.186
13	26.8	26.8	236.9	1326.9	1637.8	115.00	113.02	0.186
14	28.8	28.8	246.7	1080.2	1884.5	119.76	117.69	0.186
15	30.9	30.9	272.6	807.6	2157.1	132.33	130.05	0.186
Avg. Shaft			143.8			69.81	68.60	0.186
Toe			807.6				9801.32	0.161

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	1.003	23.285
Case Damping Factor		0.992	0.322
Unloading Quake	(% of loading quake)	73	110
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	2	
Resistance Gap (included in Toe Quake)	(mm)		2.699
Soil Plug Weight	(kN)		0.22
Soil Support Dashpot		5.500	5.007
Soil Support Weight	(kN)	10.48	10.48

CAPWAP match quality = 1.42 (Wave Up Match) ; RSA = 0
Observed: final set = 22.000 mm; blow count = 45 b/m
Computed: final set = 23.786 mm; blow count = 42 b/m

max. Top Comp. Stress = 362.0 MPa (T= 35.2 ms, max= 1.021 x Top)
max. Comp. Stress = 369.5 MPa (Z= 8.2 m, T= 36.6 ms)
max. Tens. Stress = -9.76 MPa (Z= 12.4 m, T= 66.8 ms)
max. Energy (EMX) = 168.67 kJ; max. Measured Top Displ. (DMX)=61.59 mm

Zatelliitin koepaalutus; Pile: ZET1 Test: 31-Mar-2015 15:15:
Vapaapudotusjarkale 9t; Blow: 25 CAPWAP(R) 2006-2
Inspecta OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3570.0	-0.8	362.0	-0.08	168.67	7.9	60.118
2	2.1	3588.9	-0.8	363.9	-0.08	166.59	7.9	58.674
4	4.1	3618.4	-8.3	366.9	-0.84	160.74	7.7	55.821
6	6.2	3632.6	-41.5	368.4	-4.21	154.96	7.5	53.075
8	8.2	3644.0	-66.9	369.5	-6.78	148.63	7.3	50.582
10	10.3	3602.2	-85.5	365.3	-8.67	140.97	7.0	48.219
12	12.4	3538.6	-96.3	358.8	-9.76	132.20	6.6	45.880
14	14.4	3447.0	-94.3	349.5	-9.57	122.76	6.2	43.547
16	16.5	3330.3	-64.9	337.7	-6.58	112.28	5.7	41.282
18	18.5	3193.3	-34.2	323.8	-3.47	100.82	5.3	39.177
19	19.6	2950.4	-0.5	299.2	-0.05	89.81	5.0	38.218
20	20.6	3030.0	-0.5	307.3	-0.05	88.87	4.8	37.245
21	21.6	2735.4	-0.4	277.4	-0.04	76.93	4.6	36.356
22	22.7	2820.2	-0.4	286.0	-0.05	76.11	4.4	35.452
23	23.7	2518.5	-0.4	255.4	-0.04	65.10	4.2	34.680
24	24.7	2544.7	-0.4	258.0	-0.04	64.52	4.1	33.920
25	25.8	2164.1	-0.4	219.5	-0.04	54.10	4.2	33.246
26	26.8	2269.1	-0.4	230.1	-0.04	53.71	3.9	32.641
27	27.8	1858.2	-0.5	188.4	-0.05	43.21	4.1	32.150
28	28.8	1789.5	-0.5	181.5	-0.06	42.98	4.4	31.677
29	29.9	1409.9	-0.6	143.0	-0.06	32.46	4.5	31.267
30	30.9	1362.1	-0.2	138.1	-0.02	21.17	4.5	30.859
Absolute	8.2			369.5			(T =	36.6 ms)
	12.4				-9.76		(T =	66.8 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3115.9	3048.9	2981.9	2914.9	2847.9	2780.9	2713.9	2646.9	2579.9	2512.9
RX	4293.1	4062.6	3832.2	3601.7	3371.3	3168.6	3009.5	2925.1	2910.3	2898.2
RU	3097.7	3028.8	2960.0	2891.2	2822.4	2753.6	2684.8	2615.9	2547.1	2478.3

RAU = 2750.1 (kN); RA2 = 3243.5 (kN)

Current CAPWAP Ru = 2964.7 (kN); Corresponding J(RP)= 0.23; J(RX) = 0.65

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
8.12	22.32	1862.9	1922.9	3601.5	61.587	21.995	22.000	169.9	4065.4

Zatelliitin koepaalutus; Pile: ZET1 Test: 31-Mar-2015 15:15:
Vapaapudotusjarkale 9t; Blow: 25 CAPWAP(R) 2006-2
Inspecta OP: TRe

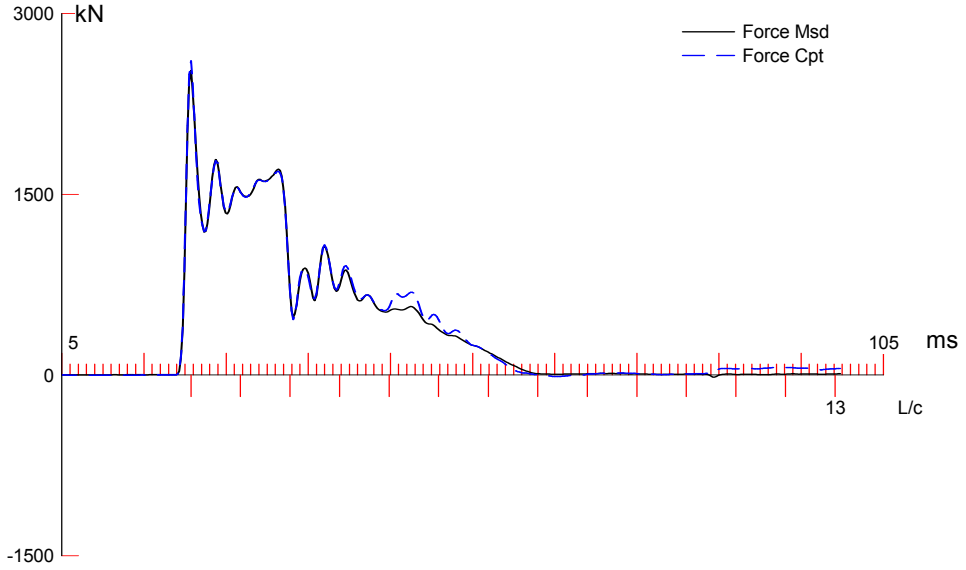
PILE PROFILE AND PILE MODEL

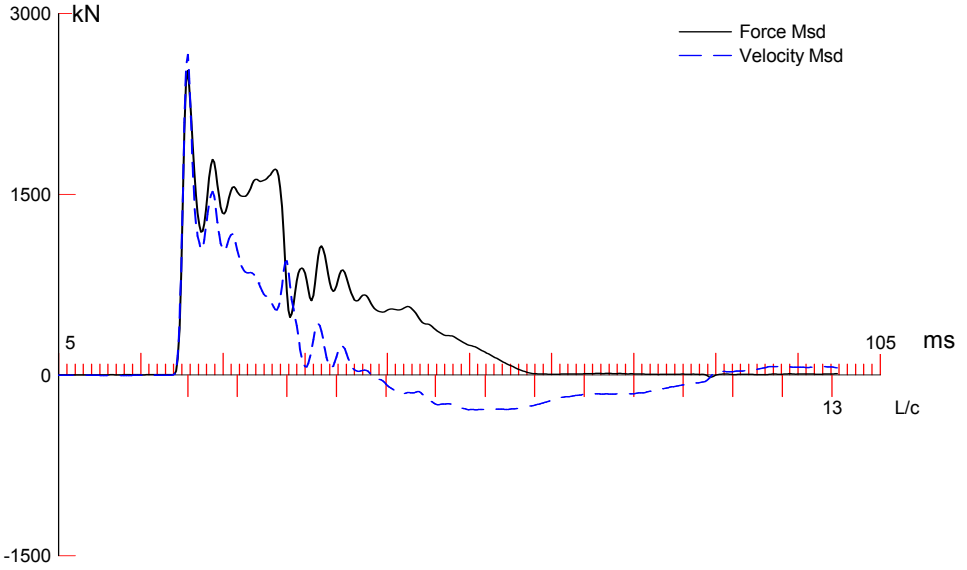
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
30.90	98.61	210000.0	78.500	1.018

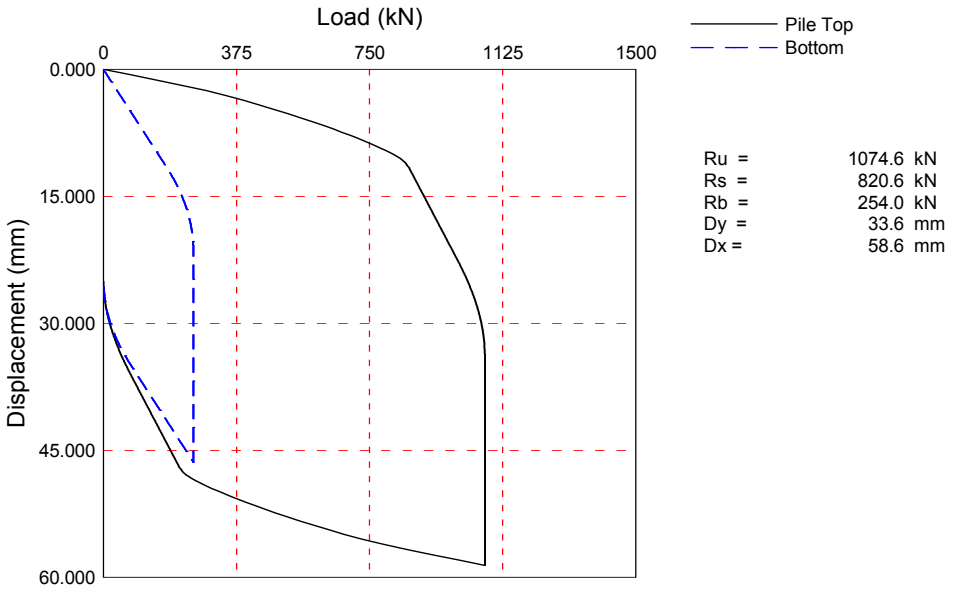
Toe Area 0.082 m^2

Top Segment Length 1.03 m, Top Impedance 404.32 kN/m/s

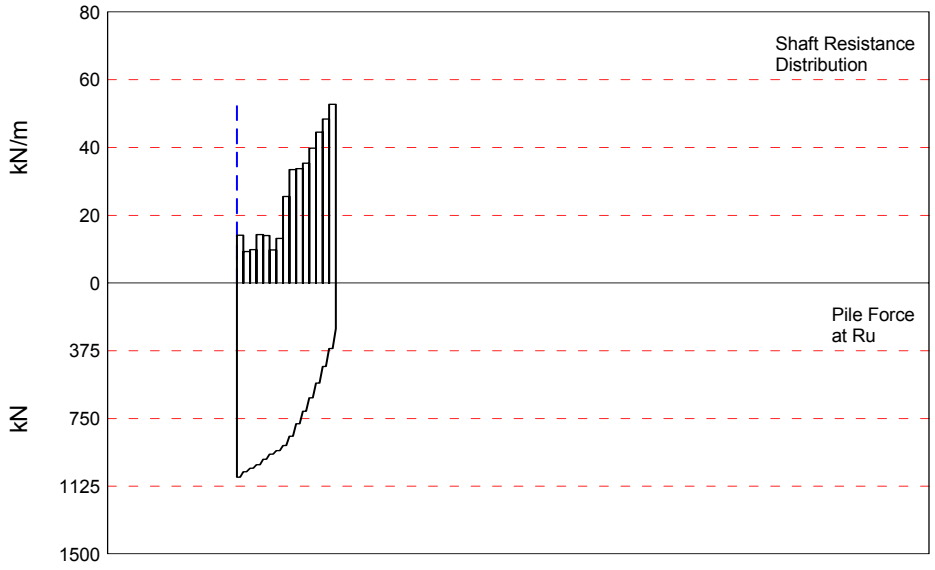
Pile Damping 1.0 %, Time Incr 0.201 ms, Wave Speed 5121.9 m/s, 2L/c 12.1 ms







Ru = 1074.6 kN
Rs = 820.6 kN
Rb = 254.0 kN
Dy = 33.6 mm
Dx = 58.6 mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Koepaalutus Zatelliitti; Pile: ZET1 Test: 04-Mar-2015 16:51:
Junttan HHK 5A; Blow: 35 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1074.6; along Shaft 820.6; at Toe 254.0 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				1074.6				
1	2.1	2.1	29.2	1045.4	29.2	14.17	13.93	0.384
2	4.1	4.1	19.3	1026.1	48.5	9.37	9.21	0.384
3	6.2	6.2	20.3	1005.8	68.8	9.85	9.68	0.384
4	8.2	8.2	29.4	976.4	98.2	14.27	14.03	0.384
5	10.3	10.3	28.9	947.5	127.1	14.03	13.79	0.384
6	12.4	12.4	20.2	927.3	147.3	9.81	9.64	0.384
7	14.4	14.4	27.1	900.2	174.4	13.16	12.93	0.384
8	16.5	16.5	52.6	847.6	227.0	25.53	25.09	0.384
9	18.5	18.5	68.9	778.7	295.9	33.45	32.87	0.384
10	20.6	20.6	69.6	709.1	365.5	33.79	33.20	0.384
11	22.7	22.7	72.9	636.2	438.4	35.39	34.78	0.384
12	24.7	24.7	82.0	554.2	520.4	39.81	39.12	0.384
13	26.8	26.8	91.7	462.5	612.1	44.51	43.75	0.384
14	28.8	28.8	99.7	362.8	711.8	48.40	47.56	0.384
15	30.9	30.9	108.8	254.0	820.6	52.82	51.90	0.384
Avg. Shaft			54.7			26.56	26.10	0.384
Toe			254.0				3082.63	0.080

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	1.929	16.494
Case Damping Factor		0.779	0.050
Unloading Quake	(% of loading quake)	300	147
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Resistance Gap (included in Toe Quake)	(mm)		7.311
Soil Plug Weight	(kN)		0.31
Soil Support Dashpot		1.000	9.877
Soil Support Weight	(kN)	10.48	10.48

CAPWAP match quality = 1.53 (Wave Up Match) ; RSA = 0
Observed: final set = 25.000 mm; blow count = 40 b/m
Computed: final set = 26.505 mm; blow count = 38 b/m

max. Top Comp. Stress = 266.8 MPa (T= 21.1 ms, max= 1.008 x Top)
max. Comp. Stress = 268.8 MPa (Z= 2.1 m, T= 21.3 ms)
max. Tens. Stress = -24.65 MPa (Z= 27.8 m, T= 27.8 ms)
max. Energy (EMX) = 61.75 kJ; max. Measured Top Displ. (DMX)=40.84 mm

Koepaalutus Zatelliitti; Pile: ZET1 Test: 04-Mar-2015 16:51:
Junttan HHK 5A; Blow: 35 CAPWAP(R) 2006-2
Inspecta OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2630.7	-18.7	266.8	-1.90	61.75	6.3	40.328
2	2.1	2650.4	-23.4	268.8	-2.38	61.66	6.3	40.033
4	4.1	2582.2	-24.5	261.8	-2.49	59.14	6.2	39.465
6	6.2	2552.2	-26.6	258.8	-2.69	57.40	6.1	38.855
8	8.2	2529.8	-26.0	256.5	-2.64	55.62	6.0	38.231
10	10.3	2474.6	-22.1	250.9	-2.24	53.25	5.9	37.661
12	12.4	2413.7	-18.1	244.8	-1.84	50.92	5.8	37.022
14	14.4	2398.0	-15.1	243.2	-1.53	49.17	5.6	36.258
16	16.5	2394.7	-11.0	242.8	-1.11	46.97	5.4	35.473
18	18.5	2332.6	-7.9	236.5	-0.81	43.24	5.2	34.782
19	19.6	2175.8	-2.8	220.6	-0.29	38.81	5.0	34.480
20	20.6	2227.2	-3.7	225.9	-0.37	38.69	4.9	34.141
21	21.6	2075.2	-0.9	210.4	-0.09	34.32	4.8	33.831
22	22.7	2129.2	-0.9	215.9	-0.09	34.22	4.7	33.522
23	23.7	1977.9	-0.8	200.6	-0.08	29.73	4.6	33.292
24	24.7	2036.7	-0.8	206.5	-0.08	29.66	4.4	33.054
25	25.8	1872.3	-24.9	189.9	-2.53	24.75	4.3	32.815
26	26.8	1934.5	-98.3	196.2	-9.97	24.68	4.1	32.549
27	27.8	1726.8	-243.1	175.1	-24.65	19.38	4.0	32.303
28	28.8	1612.2	-111.5	163.5	-11.30	19.34	4.8	32.125
29	29.9	1081.7	-110.7	109.7	-11.22	13.56	5.8	32.010
30	30.9	625.0	-0.3	63.4	-0.03	6.87	6.3	31.877
Absolute	2.1			268.8			(T =	21.3 ms)
	27.8				-24.65		(T =	27.8 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	2522.6	2244.7	1966.9	1689.0	1411.1	1133.3	855.4	577.5	299.7	21.8
RX	2522.6	2244.7	1966.9	1689.0	1411.1	1241.1	1143.2	1050.7	961.4	876.3
RU	2522.6	2244.7	1966.9	1689.0	1411.1	1133.3	855.4	577.5	299.7	21.8

RAU = 522.2 (kN); RA2 = 1471.6 (kN)

Current CAPWAP Ru = 1074.6 (kN); Corresponding J(RP)= 0.52; J(RX) = 0.67

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
6.75	20.91	2728.7	2572.6	2572.6	40.840	25.003	25.000	62.2	1890.3

Koepaalutus Zatelliitti; Pile: ZET1 Test: 04-Mar-2015 16:51:
Junttan HHK 5A; Blow: 35 CAPWAP(R) 2006-2
Inspecta OP: TRe

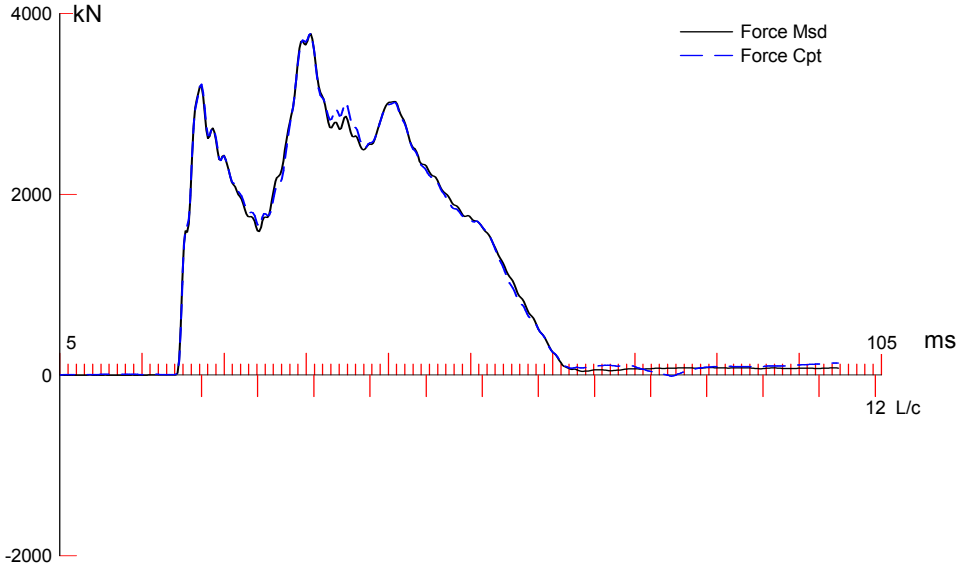
PILE PROFILE AND PILE MODEL

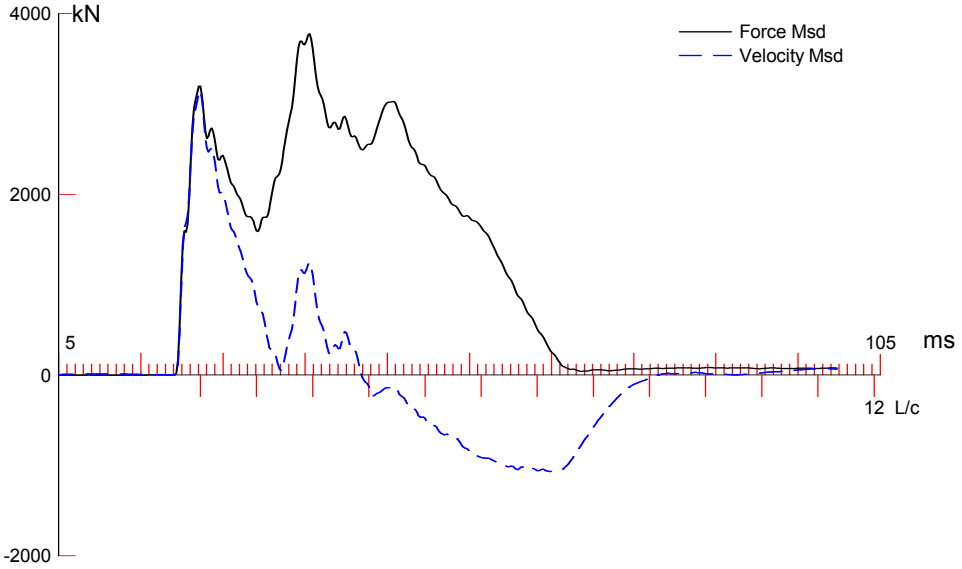
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
30.90	98.61	210000.0	78.500	1.018

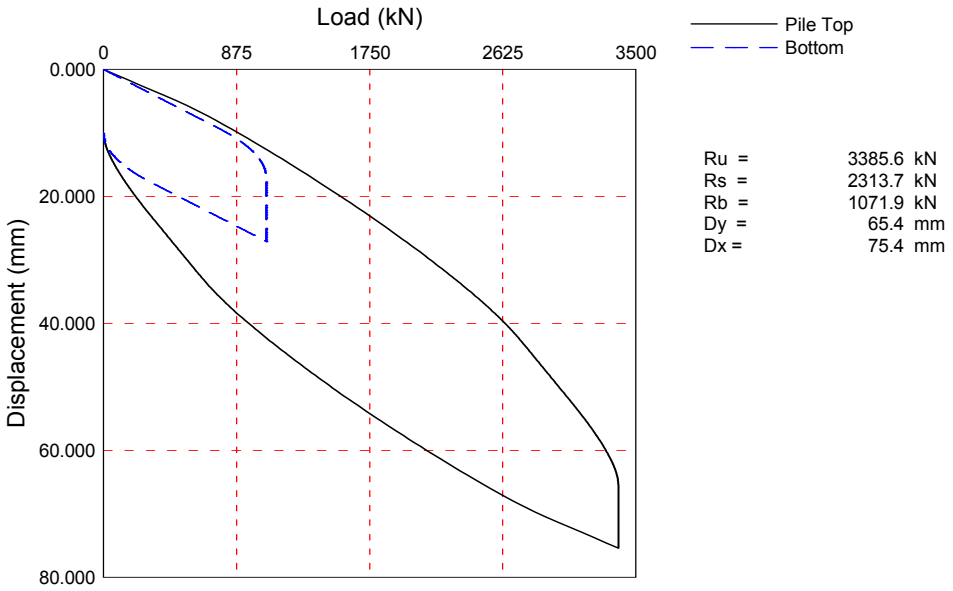
Toe Area 0.082 m^2

Top Segment Length 1.03 m, Top Impedance 404.32 kN/m/s

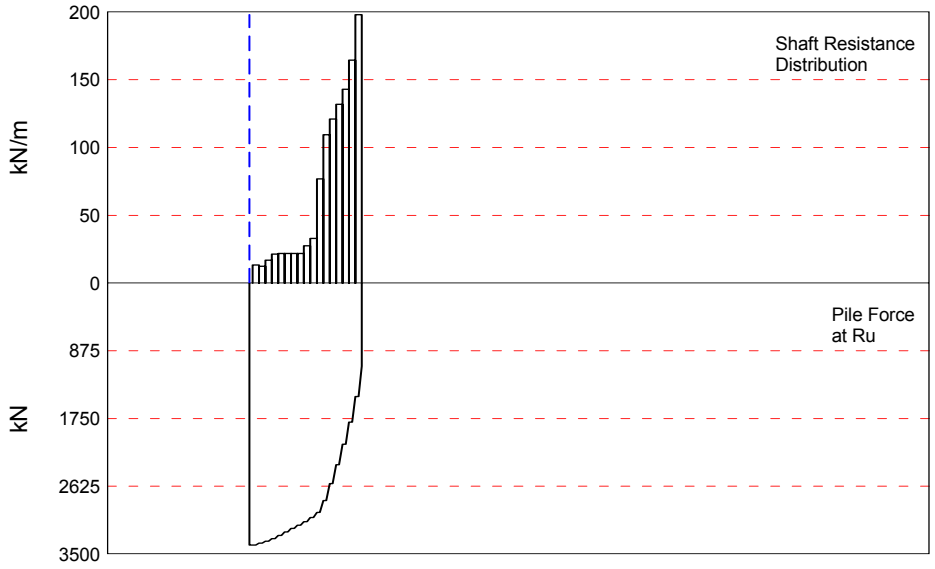
Pile Damping 1.0 %, Time Incr 0.201 ms, Wave Speed 5121.9 m/s, 2L/c 12.1 ms







Ru = 3385.6 kN
Rs = 2313.7 kN
Rb = 1071.9 kN
Dy = 65.4 mm
Dx = 75.4 mm



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Zatelliitin koepaalutus; Pile: ZET2 Test: 31-Mar-2015 16:31:
Vapaapudotusjarkale 9t; Blow: 27 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 3385.6; along Shaft 2313.7; at Toe 1071.9 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				3385.6				
1	3.0	3.0	26.7	3358.9	26.7	8.90	8.75	0.222
2	5.0	5.0	24.6	3334.3	51.3	12.30	12.09	0.222
3	7.0	7.0	33.8	3300.5	85.1	16.90	16.61	0.222
4	9.0	9.0	42.6	3257.9	127.7	21.30	20.93	0.222
5	11.0	11.0	43.9	3214.0	171.6	21.95	21.57	0.222
6	13.0	13.0	43.9	3170.1	215.5	21.95	21.57	0.222
7	15.0	15.0	43.9	3126.2	259.4	21.95	21.57	0.222
8	17.0	17.0	43.9	3082.3	303.3	21.95	21.57	0.222
9	19.0	19.0	54.9	3027.4	358.2	27.45	26.98	0.222
10	21.0	21.0	66.0	2961.4	424.2	33.00	32.43	0.222
11	23.0	23.0	153.9	2807.5	578.1	76.95	75.62	0.222
12	25.0	25.0	219.0	2588.5	797.1	109.50	107.61	0.222
13	27.0	27.0	241.9	2346.6	1039.0	120.95	118.86	0.222
14	29.0	29.0	263.9	2082.7	1302.9	131.95	129.67	0.222
15	31.0	31.0	286.1	1796.6	1589.0	143.05	140.58	0.222
16	33.0	33.0	328.9	1467.7	1917.9	164.45	161.61	0.222
17	35.0	35.0	395.8	1071.9	2313.7	197.90	194.48	0.222
Avg. Shaft			136.1			66.11	64.96	0.222
Toe			1071.9				13008.95	0.205

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	4.146	13.138
Case Damping Factor		1.270	0.543
Unloading Quake	(% of loading quake)	30	82
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Resistance Gap (included in Toe Quake)	(mm)		7.774
Soil Plug Weight	(kN)		0.27

CAPWAP match quality = 1.87 (Wave Up Match) ; RSA = 0
Observed: final set = 10.000 mm; blow count = 100 b/m
Computed: final set = 8.720 mm; blow count = 115 b/m

max. Top Comp. Stress = 381.4 MPa (T= 35.9 ms, max= 1.010 x Top)
max. Comp. Stress = 385.1 MPa (Z= 7.0 m, T= 37.1 ms)
max. Tens. Stress = -32.26 MPa (Z= 27.0 m, T= 74.2 ms)
max. Energy (EMX) = 152.20 kJ; max. Measured Top Displ. (DMX)=61.23 mm

Zatelliitin koepaalutus; Pile: ZET2 Test: 31-Mar-2015 16:31:
Vapaapudotusjarkale 9t; Blow: 27 CAPWAP(R) 2006-2
Inspecta OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3761.2	-11.4	381.4	-1.15	152.20	7.7	58.512
2	2.0	3733.9	-14.2	378.6	-1.44	150.54	7.6	57.249
4	4.0	3723.8	-27.0	377.6	-2.74	144.16	7.5	54.637
6	6.0	3759.8	-44.8	381.3	-4.54	137.83	7.4	51.907
8	8.0	3759.2	-72.5	381.2	-7.35	130.62	7.2	49.129
10	10.0	3676.3	-103.9	372.8	-10.54	122.66	7.1	46.290
12	12.0	3571.0	-136.2	362.1	-13.81	114.57	7.0	43.368
14	14.0	3467.8	-165.1	351.7	-16.75	106.88	6.8	40.487
16	16.0	3410.8	-186.8	345.9	-18.95	99.94	6.7	37.772
18	18.0	3410.6	-220.9	345.8	-22.40	93.15	6.4	35.010
20	20.0	3445.7	-251.7	349.4	-25.52	85.87	6.0	32.200
22	22.0	3472.1	-278.1	352.1	-28.20	78.33	5.5	29.351
24	24.0	3339.2	-292.4	338.6	-29.65	67.72	5.0	26.595
26	26.0	3138.1	-299.9	318.2	-30.41	56.53	4.5	24.119
28	28.0	2859.2	-302.2	289.9	-30.64	46.29	3.9	21.885
29	29.0	2889.6	-312.9	293.0	-31.73	45.07	3.7	20.801
30	30.0	2585.7	-287.5	262.2	-29.16	36.90	3.6	19.826
31	31.0	2594.1	-300.1	263.1	-30.43	35.92	3.5	18.848
32	32.0	2235.4	-262.3	226.7	-26.60	28.37	3.2	17.994
33	33.0	2269.0	-260.6	230.1	-26.43	27.62	3.2	17.137
34	34.0	1892.7	-208.2	191.9	-21.12	20.26	3.1	16.425
35	35.0	1883.0	-206.0	190.9	-20.89	12.18	3.1	15.713
Absolute	7.0			385.1			(T =	37.1 ms)
	27.0				-32.26		(T =	74.2 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3083.2	3028.3	2973.3	2918.3	2863.3	2808.4	2753.4	2698.4	2643.4	2588.4
RX	4445.3	4251.2	4057.0	3862.9	3668.8	3475.5	3289.0	3190.0	3095.1	3093.3
RU	3083.2	3028.3	2973.3	2918.3	2863.3	2808.4	2753.4	2698.4	2643.4	2588.4

RAU = 2626.9 (kN); RA2 = 2874.8 (kN)

Current CAPWAP Ru = 3385.6 (kN); Corresponding J(RP)= 0.00; J(RX) = 0.55

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
7.83	22.45	1849.1	1784.0	3787.8	61.231	10.002	10.000	156.4	4390.6

Zatelliitin koepaalutus; Pile: ZET2 Test: 31-Mar-2015 16:31:
Vapaapudotusjarkale 9t; Blow: 27 CAPWAP(R) 2006-2
Inspecta OP: TRe

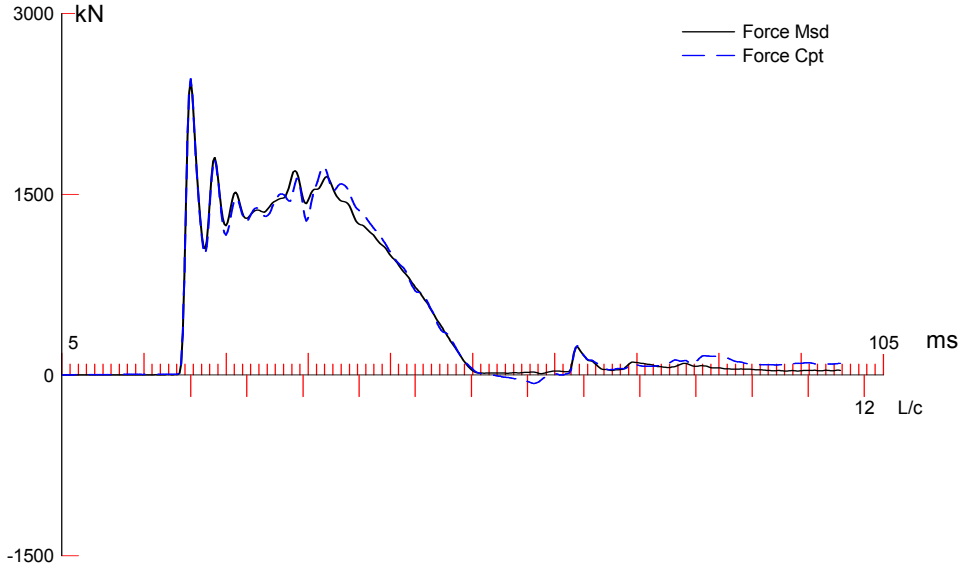
PILE PROFILE AND PILE MODEL

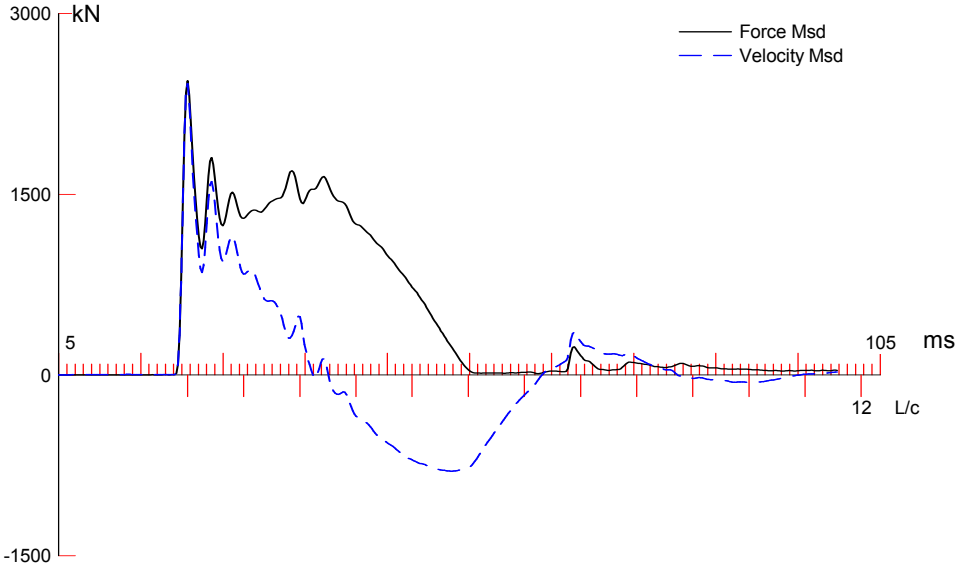
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
35.00	98.61	210000.0	78.500	1.018

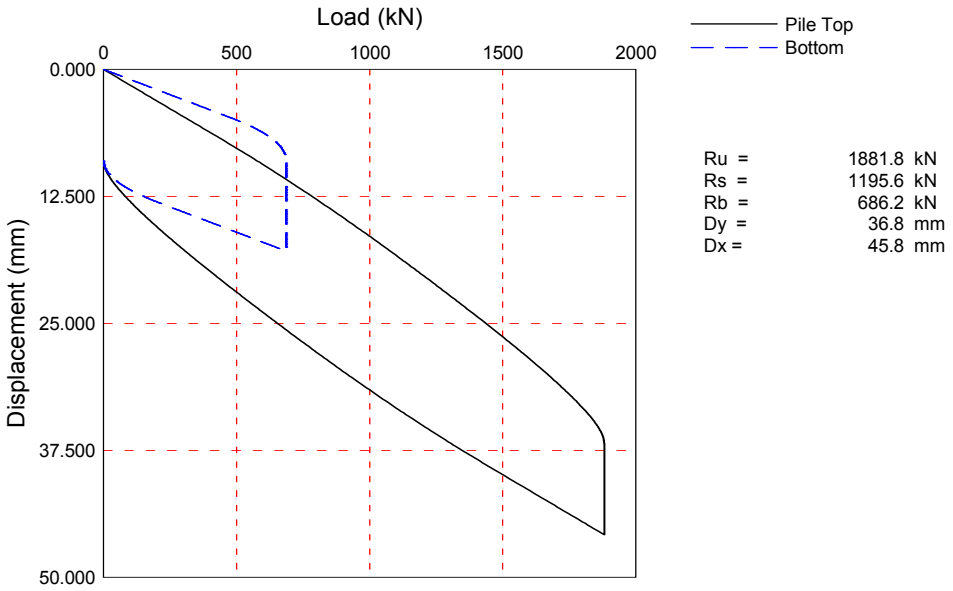
Toe Area 0.082 m^2

Top Segment Length 1.00 m, Top Impedance 404.32 kN/m/s

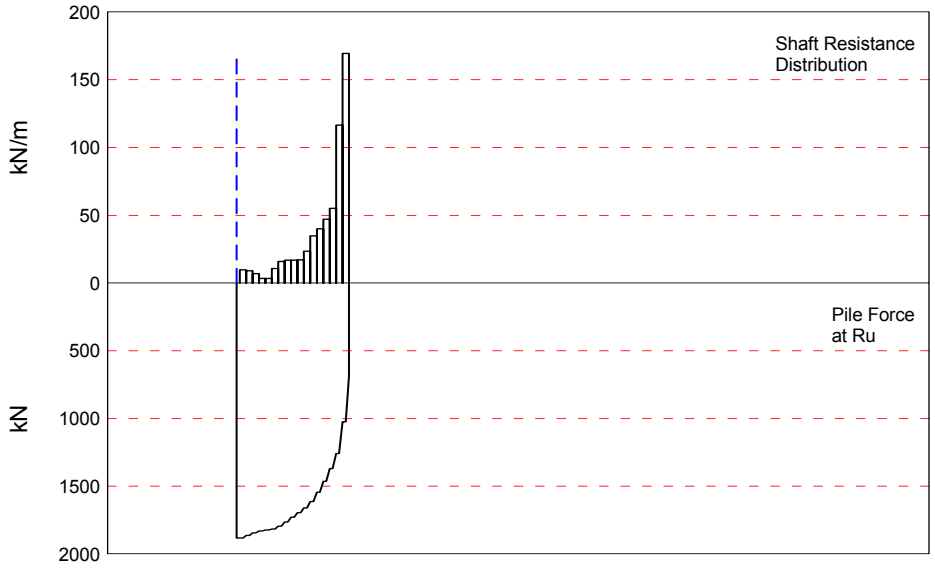
Pile Damping 1.0 %, Time Incr 0.195 ms, Wave Speed 5121.9 m/s, 2L/c 13.7 ms







Ru = 1881.8 kN
Rs = 1195.6 kN
Rb = 686.2 kN
Dy = 36.8 mm
Dx = 45.8 mm



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Koepaalutus Zatelliitti; Pile: ZET2 Test: 04-Mar-2015 16:36:
Junttan HHK 5A; Blow: 14 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1881.8; along Shaft 1195.6; at Toe 686.2 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m	Quake mm
				1881.8					
1	3.0	3.0	19.7	1862.1	19.7	6.57	6.45	0.515	7.500
2	5.0	5.0	18.1	1844.0	37.8	9.05	8.89	0.515	7.499
3	7.0	7.0	14.1	1829.9	51.9	7.05	6.93	0.515	7.499
4	9.0	9.0	6.9	1823.0	58.8	3.45	3.39	0.515	7.499
5	11.0	11.0	6.9	1816.1	65.7	3.45	3.39	0.515	7.499
6	13.0	13.0	21.8	1794.3	87.5	10.90	10.71	0.515	7.499
7	15.0	15.0	31.9	1762.4	119.4	15.95	15.67	0.515	7.499
8	17.0	17.0	33.8	1728.6	153.2	16.90	16.61	0.515	7.499
9	19.0	19.0	34.0	1694.6	187.2	17.00	16.71	0.515	7.499
10	21.0	21.0	34.5	1660.1	221.7	17.25	16.95	0.515	7.499
11	23.0	23.0	47.2	1612.9	268.9	23.60	23.19	0.515	7.499
12	25.0	25.0	69.6	1543.3	338.5	34.80	34.20	0.515	7.499
13	27.0	27.0	80.2	1463.1	418.7	40.10	39.41	0.515	7.499
14	29.0	29.0	94.1	1369.0	512.8	47.05	46.24	0.515	7.499
15	31.0	31.0	110.6	1258.4	623.4	55.30	54.35	0.515	7.499
16	33.0	33.0	233.3	1025.1	856.7	116.65	114.64	0.515	7.499
17	35.0	35.0	338.9	686.2	1195.6	169.45	166.53	0.515	6.042
Avg. Shaft			70.3			34.16	33.57	0.515	7.086
Toe			686.2				8327.64	0.035	6.841

Soil Model Parameters/Extensions		Shaft	Toe
Case Damping Factor		1.523	0.060
Unloading Quake	(% of loading quake)	132	66
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	78	
Soil Support Dashpot		2.300	4.359
Soil Support Weight	(kN)	10.18	10.18

CAPWAP match quality = 1.58 (Force Match) ; RSA = 0
Observed: final set = 9.000 mm; blow count = 111 b/m
Computed: final set = 4.751 mm; blow count = 210 b/m

max. Top Comp. Stress = 249.4 MPa (T= 20.9 ms, max= 1.021 x Top)
max. Comp. Stress = 254.6 MPa (Z= 3.0 m, T= 21.5 ms)
max. Tens. Stress = -19.31 MPa (Z= 15.0 m, T= 59.5 ms)
max. Energy (EMX) = 53.93 kJ; max. Measured Top Displ. (DMX)=36.01 mm

Koepaalutus Zatelliitti; Pile: ZET2 Test: 04-Mar-2015 16:36:
Junttan HHK 5A; Blow: 14 CAPWAP(R) 2006-2
Inspecta OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2459.5	-69.8	249.4	-7.08	53.93	5.9	35.248
2	2.0	2495.3	-90.7	253.0	-9.19	53.67	5.9	34.445
4	4.0	2458.2	-92.8	249.3	-9.41	50.68	5.8	32.775
6	6.0	2420.6	-100.7	245.5	-10.21	47.94	5.8	31.132
8	8.0	2385.9	-116.6	241.9	-11.83	45.82	5.7	29.651
10	10.0	2370.7	-140.7	240.4	-14.26	44.10	5.7	28.088
12	12.0	2370.1	-164.4	240.3	-16.67	42.26	5.6	26.446
14	14.0	2338.7	-171.7	237.2	-17.41	39.73	5.5	24.864
16	16.0	2283.0	-172.1	231.5	-17.45	36.84	5.3	23.306
18	18.0	2223.3	-167.0	225.4	-16.94	33.99	5.2	21.744
20	20.0	2164.4	-161.9	219.5	-16.42	31.37	5.1	20.240
22	22.0	2129.2	-157.7	215.9	-15.99	28.92	4.9	18.777
24	24.0	2087.9	-148.3	211.7	-15.04	26.32	4.7	17.385
26	26.0	2005.1	-141.6	203.3	-14.36	23.43	4.4	16.127
28	28.0	1914.8	-135.6	194.2	-13.75	20.54	4.2	14.916
29	29.0	1970.1	-141.8	199.8	-14.37	20.17	4.1	14.322
30	30.0	1816.5	-130.0	184.2	-13.18	17.73	3.9	13.787
31	31.0	1898.2	-135.3	192.5	-13.72	17.47	3.7	13.293
32	32.0	1755.3	-128.2	178.0	-13.00	15.17	3.5	12.850
33	33.0	1698.4	-133.7	172.2	-13.56	14.97	3.7	12.408
34	34.0	1108.5	-103.5	112.4	-10.49	11.09	4.1	12.075
35	35.0	1094.5	-109.4	111.0	-11.09	5.83	4.1	11.748
Absolute	3.0			254.6			(T =	21.5 ms)
	15.0				-19.31		(T =	59.5 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	2935.0	2738.5	2541.9	2345.3	2148.7	1952.1	1755.5	1558.9	1362.3	1165.7
RX	2935.0	2738.5	2541.9	2345.3	2148.7	1991.6	1897.2	1802.7	1714.1	1658.5
RU	2935.0	2738.5	2541.9	2345.3	2148.7	1952.1	1755.5	1558.9	1362.3	1165.7

RAU = 433.1 (kN); RA2 = 1727.7 (kN)

Current CAPWAP Ru = 1881.8 (kN); Corresponding J(RP)= 0.54; J(RX) = 0.62

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
6.04	20.89	2442.2	2458.7	2458.7	36.010	9.001	9.000	55.9	2485.9

PILE PROFILE AND PILE MODEL

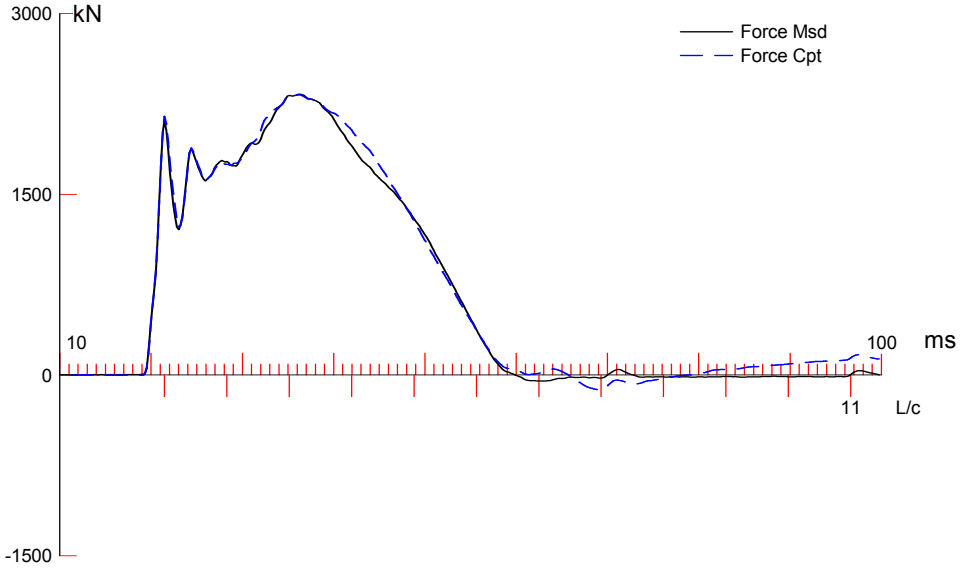
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
35.00	98.61	210000.0	78.500	1.018

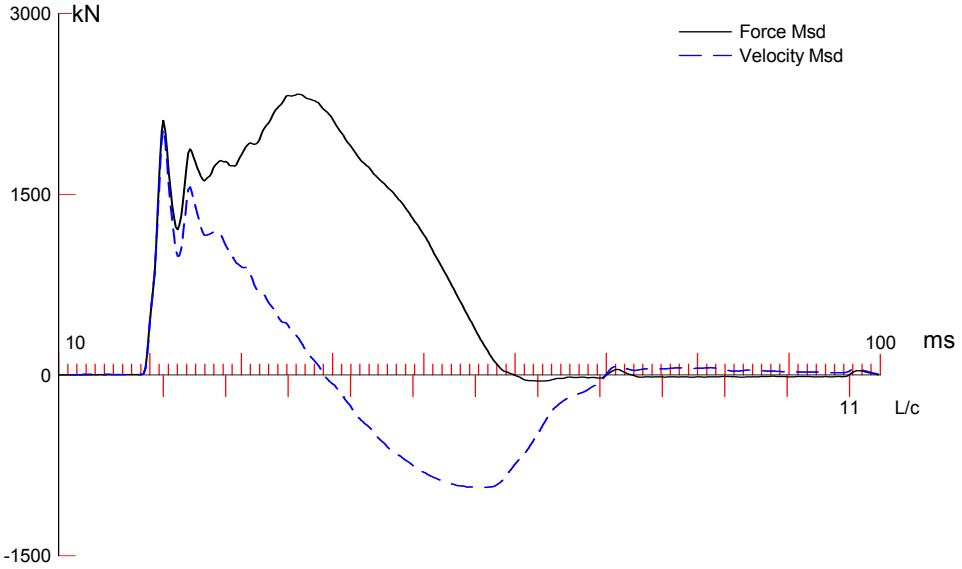
Koepaalutus Zatelliitti; Pile: ZET2 Test: 04-Mar-2015 16:36:
Junttan HHK 5A; Blow: 14 CAPWAP(R) 2006-2
Inspecta OP: TRe

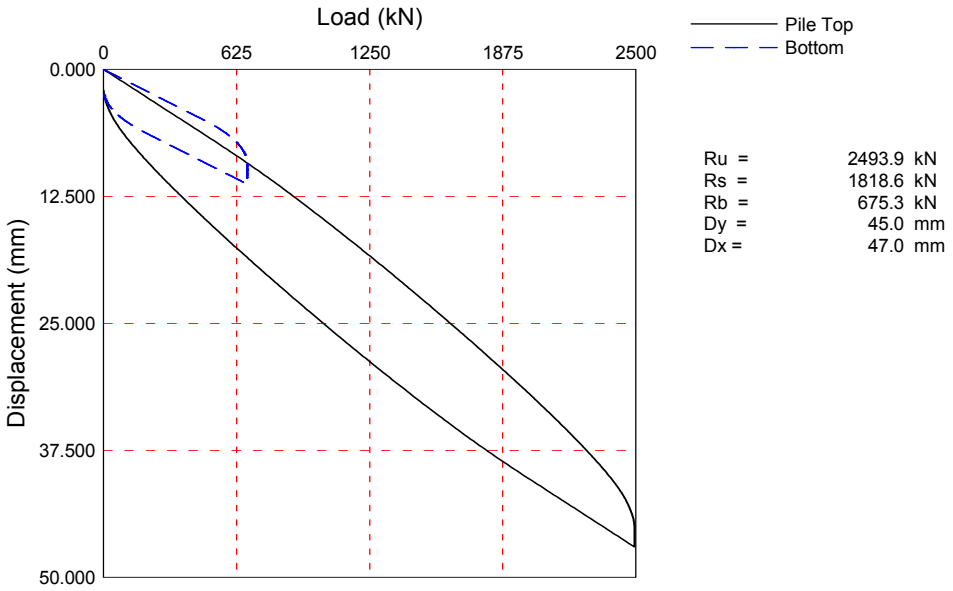
Toe Area 0.082 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.00	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.00	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02
3	3.00	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02
35	35.00	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02

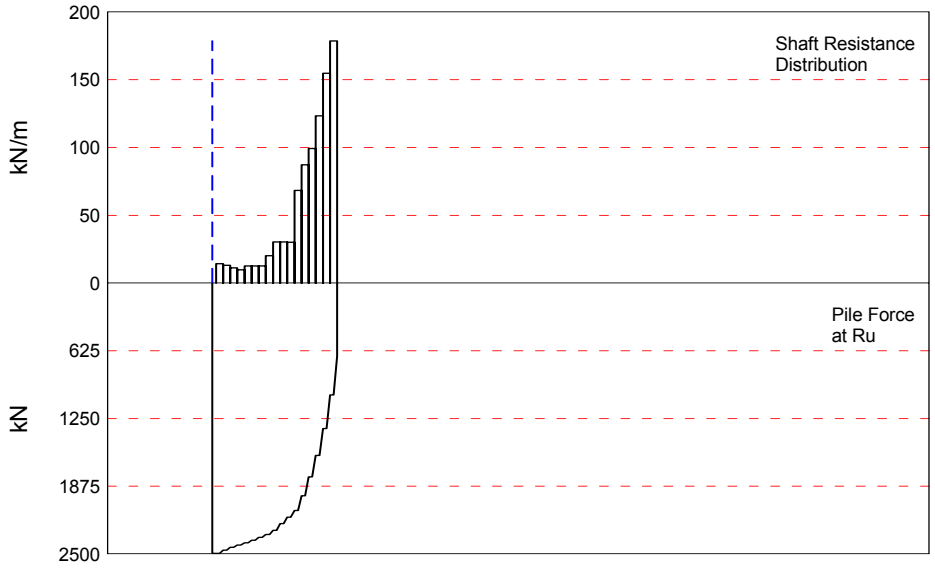
Pile Damping 1.0 %, Time Incr 0.195 ms, Wave Speed 5121.9 m/s, 2L/c 13.7 ms







Ru = 2493.9 kN
Rs = 1818.6 kN
Rb = 675.3 kN
Dy = 45.0 mm
Dx = 47.0 mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Zatelliitin koepaalutus 14vrk; Pile: ZET2 14 vrk Test: 18-Mar-2015 12:15:
Junttan HHK 7A; Blow: 6 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2493.9; along Shaft 1818.6; at Toe 675.3 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m	Quake mm
				2493.9					
1	3.0	3.0	28.7	2465.2	28.7	9.57	9.40	0.546	7.500
2	5.0	5.0	26.2	2439.0	54.9	13.10	12.87	0.546	7.500
3	7.0	7.0	22.3	2416.7	77.2	11.15	10.96	0.546	7.500
4	9.0	9.0	19.8	2396.9	97.0	9.90	9.73	0.546	7.500
5	11.0	11.0	25.2	2371.7	122.2	12.60	12.38	0.546	7.500
6	13.0	13.0	25.3	2346.4	147.5	12.65	12.43	0.546	7.500
7	15.0	15.0	25.4	2321.0	172.9	12.70	12.48	0.546	7.500
8	17.0	17.0	40.6	2280.4	213.5	20.30	19.95	0.546	7.500
9	19.0	19.0	60.8	2219.6	274.3	30.40	29.88	0.546	7.500
10	21.0	21.0	60.6	2159.0	334.9	30.30	29.78	0.546	7.500
11	23.0	23.0	60.3	2098.7	395.2	30.15	29.63	0.546	7.500
12	25.0	25.0	136.6	1962.1	531.8	68.30	67.12	0.546	7.500
13	27.0	27.0	174.4	1787.7	706.2	87.20	85.70	0.546	7.500
14	29.0	29.0	198.7	1589.0	904.9	99.35	97.64	0.546	7.500
15	31.0	31.0	246.8	1342.2	1151.7	123.40	121.27	0.546	7.500
16	33.0	33.0	309.4	1032.8	1461.1	154.70	152.03	0.546	6.507
17	35.0	35.0	357.5	675.3	1818.6	178.75	175.67	0.546	5.378
Avg. Shaft			107.0			51.96	51.06	0.546	6.914
Toe			675.3				8195.68	0.461	7.148

Soil Model Parameters/Extensions		Shaft	Toe
Case Damping Factor		2.456	0.770
Unloading Quake	(% of loading quake)	61	89
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	3	
Resistance Gap (included in Toe Quake) (mm)			0.122

CAPWAP match quality = 1.69 (Force Match) ; RSA = 0
Observed: final set = 2.000 mm; blow count = 500 b/m
Computed: final set = 0.166 mm; blow count = 6013 b/m

max. Top Comp. Stress = 235.9 MPa (T= 36.3 ms, max= 1.024 x Top)
max. Comp. Stress = 241.6 MPa (Z= 3.0 m, T= 35.9 ms)
max. Tens. Stress = -27.96 MPa (Z= 23.0 m, T= 66.0 ms)
max. Energy (EMX) = 71.13 kJ; max. Measured Top Displ. (DMX)=40.93 mm

Zatelliitin koepaalutus 14vrk; Pile: ZET2 14 vrk — Test: 18-Mar-2015 12:15:
Junttan HHK 7A; Blow: 6 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2326.1	-122.0	235.9	-12.37	71.13	5.0	39.859
2	2.0	2362.7	-140.4	239.6	-14.24	70.08	4.9	38.770
4	4.0	2361.4	-152.8	239.5	-15.50	65.08	4.8	36.588
6	6.0	2363.9	-161.6	239.7	-16.39	60.47	4.7	34.404
8	8.0	2363.5	-167.9	239.7	-17.03	56.33	4.6	32.222
10	10.0	2362.1	-170.1	239.5	-17.25	52.49	4.5	30.037
12	12.0	2350.8	-179.2	238.4	-18.18	48.47	4.4	27.854
14	14.0	2338.9	-205.3	237.2	-20.82	44.61	4.4	25.677
16	16.0	2324.7	-231.7	235.7	-23.50	40.94	4.2	23.515
18	18.0	2291.1	-251.0	232.3	-25.45	36.85	4.1	21.379
20	20.0	2234.9	-258.8	226.6	-26.24	32.39	3.9	19.287
22	22.0	2177.7	-264.9	220.8	-26.86	28.39	3.7	17.254
24	24.0	2117.4	-266.4	214.7	-27.02	24.83	3.4	15.283
26	26.0	1977.8	-239.1	200.6	-24.25	20.28	3.0	13.411
28	28.0	1803.0	-201.9	182.8	-20.47	16.01	2.6	11.688
29	29.0	1807.2	-207.2	183.3	-21.01	15.31	2.4	10.868
30	30.0	1607.3	-161.3	163.0	-16.35	12.37	2.2	10.136
31	31.0	1611.7	-166.8	163.4	-16.91	11.81	2.1	9.406
32	32.0	1373.3	-113.9	139.3	-11.55	9.20	1.9	8.779
33	33.0	1378.3	-119.6	139.8	-12.13	8.79	1.8	8.153
34	34.0	1095.8	-60.1	111.1	-6.10	6.37	1.6	7.648
35	35.0	1099.9	-66.2	111.5	-6.71	3.77	1.5	7.144
Absolute	3.0			241.6			(T =	35.9 ms)
	23.0				-27.96		(T =	66.0 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3048.8	2934.1	2819.5	2704.8	2590.2	2475.5	2360.9	2246.2	2131.6	2016.9
RX	3050.5	2937.1	2823.7	2710.3	2597.0	2485.1	2420.9	2356.7	2293.6	2246.1
RU	3048.8	2934.1	2819.5	2704.8	2590.2	2475.5	2360.9	2246.2	2131.6	2016.9

RAU = 225.9 (kN); RA2 = 2166.6 (kN)

Current CAPWAP Ru = 2493.9 (kN); Corresponding J(RP)= 0.48; J(RX) = 0.49

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
5.09	21.67	2058.8	2136.5	2334.8	40.932	2.146	2.000	71.9	3351.7

PILE PROFILE AND PILE MODEL

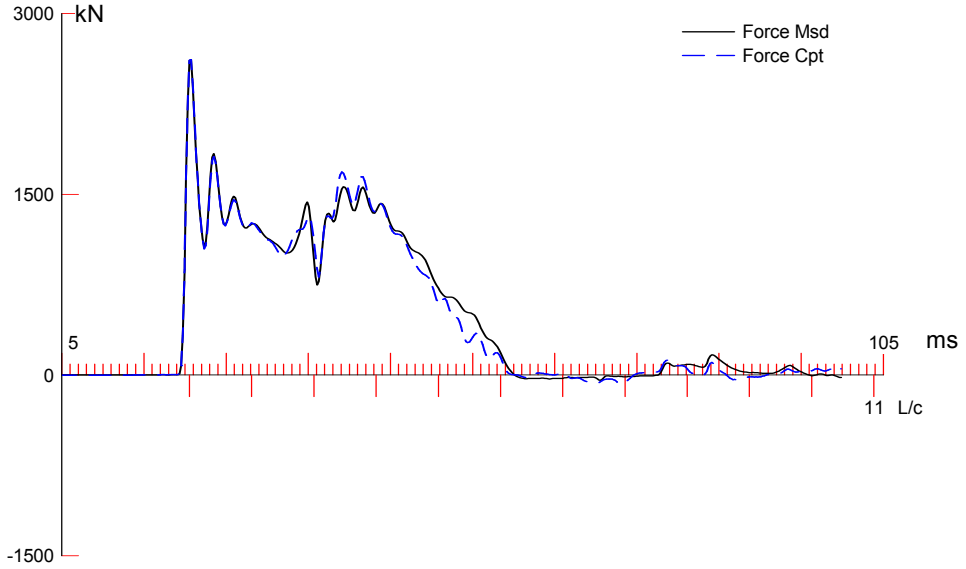
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
35.00	98.61	210000.0	78.500	1.018

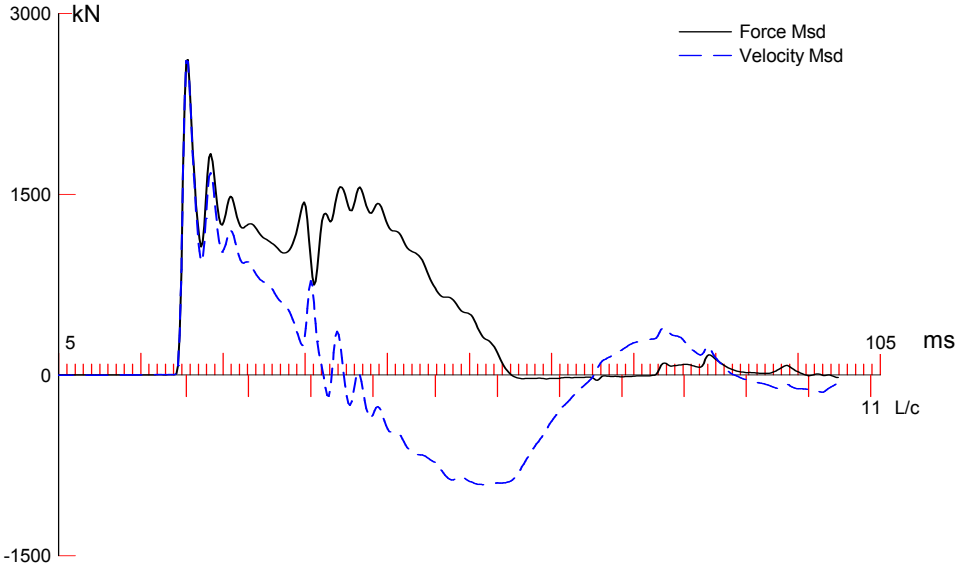
Zatelliitin koepaalutus 14vrk; Pile: ZET2 14 vrk Test: 18-Mar-2015 12:15:
Junttan HHK 7A; Blow: 6 CAPWAP(R) 2006-2
Inspecta OP: TRe

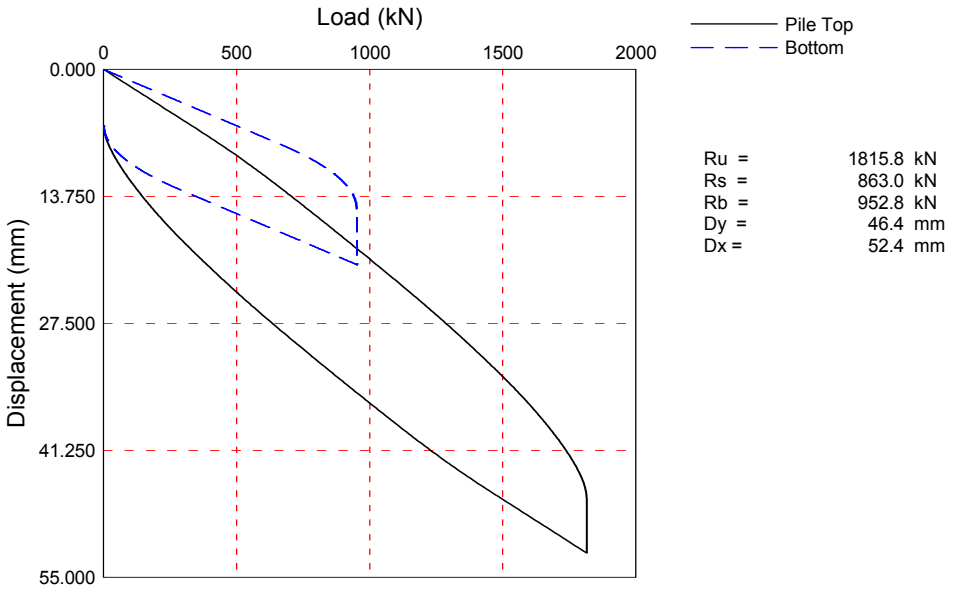
Toe Area 0.082 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.00	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.00	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.04
3	3.00	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.05
35	35.00	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.05

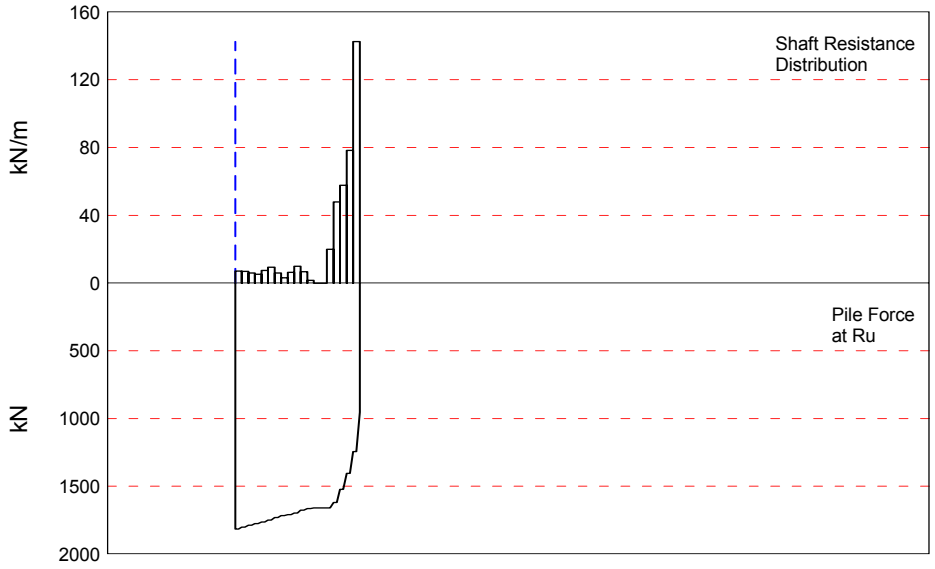
Pile Damping 1.0 %, Time Incr 0.195 ms, Wave Speed 5121.9 m/s, 2L/c 13.7 ms







Ru = 1815.8 kN
Rs = 863.0 kN
Rb = 952.8 kN
Dy = 46.4 mm
Dx = 52.4 mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Koepaalutus Zatelliitti; Pile: ZET3 0h — Test: 03-Mar-2015 10:34:
Junttan HHK 5A; Blow: 1886 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1815.8; along Shaft 863.0; at Toe 952.8 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				1815.8				
1	2.0	1.2	14.6	1801.2	14.6	11.75	11.55	0.490
2	4.1	3.3	14.3	1786.9	28.9	7.00	6.88	0.490
3	6.1	5.3	12.2	1774.7	41.1	5.97	5.87	0.490
4	8.2	7.4	10.6	1764.1	51.7	5.19	5.10	0.490
5	10.2	9.4	15.5	1748.6	67.2	7.59	7.46	0.490
6	12.3	11.5	19.2	1729.4	86.4	9.40	9.24	0.490
7	14.3	13.5	12.3	1717.1	98.7	6.02	5.92	0.490
8	16.3	15.5	6.6	1710.5	105.3	3.23	3.18	0.490
9	18.4	17.6	12.9	1697.6	118.2	6.32	6.21	0.490
10	20.4	19.6	20.3	1677.3	138.5	9.94	9.77	0.490
11	22.5	21.7	13.8	1663.5	152.3	6.76	6.64	0.490
12	24.5	23.7	3.3	1660.2	155.6	1.62	1.59	0.490
13	26.5	25.7	0.0	1660.2	155.6	0.00	0.00	0.000
14	28.6	27.8	0.0	1660.2	155.6	0.00	0.00	0.000
15	30.6	29.8	40.8	1619.4	196.4	19.98	19.63	0.490
16	32.7	31.9	97.8	1521.6	294.2	47.89	47.07	0.490
17	34.7	33.9	117.9	1403.7	412.1	57.73	56.74	0.490
18	36.8	36.0	159.7	1244.0	571.8	78.20	76.85	0.490
19	38.8	38.0	291.2	952.8	863.0	142.60	140.14	0.490
Avg. Shaft			45.4			22.71	22.32	0.490
Toe			952.8				11563.51	0.058

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	7.476	11.640
Case Damping Factor		1.046	0.137
Unloading Quake	(% of loading quake)	99	166
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	51	
Resistance Gap (included in Toe Quake)	(mm)		4.664
Soil Plug Weight	(kN)		0.09
Soil Support Dashpot		0.000	10.000
Soil Support Weight	(kN)	0.00	10.39

CAPWAP match quality = 1.99 (Force Match) ; RSA = 0
Observed: final set = 6.000 mm; blow count = 167 b/m
Computed: final set = 6.035 mm; blow count = 166 b/m

max. Top Comp. Stress = 265.4 MPa (T= 20.9 ms, max= 1.010 x Top)
max. Comp. Stress = 268.0 MPa (Z= 2.0 m, T= 21.3 ms)
max. Tens. Stress = -42.12 MPa (Z= 30.6 m, T= 67.2 ms)
max. Energy (EMX) = 59.58 kJ; max. Measured Top Displ. (DMX)=41.27 mm

Koepaalutus Zatelliitti; Pile: ZET3 0h — Test: 03-Mar-2015 10:34:
Junttan HHK 5A; Blow: 1886 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2617.6	-74.0	265.4	-7.50	59.58	6.4	40.462
2	2.0	2643.0	-106.9	268.0	-10.84	59.39	6.4	39.634
4	4.1	2614.9	-123.9	265.2	-12.56	56.70	6.3	38.149
6	6.1	2584.8	-136.7	262.1	-13.86	54.47	6.3	36.782
8	8.2	2562.6	-162.9	259.9	-16.52	52.54	6.2	35.480
10	10.2	2553.5	-179.2	258.9	-18.17	50.52	6.1	33.980
12	12.3	2529.1	-185.4	256.5	-18.80	48.00	6.1	32.389
14	14.3	2481.7	-202.7	251.7	-20.56	45.34	6.0	30.845
16	16.3	2453.6	-221.2	248.8	-22.43	43.28	6.0	29.357
18	18.4	2455.2	-259.0	249.0	-26.27	41.69	5.9	27.865
20	20.4	2442.0	-280.0	247.6	-28.40	39.79	5.9	26.430
22	22.5	2392.9	-305.5	242.7	-30.98	37.44	5.8	24.952
24	24.5	2351.8	-332.3	238.5	-33.70	35.49	5.8	23.444
26	26.5	2340.2	-354.9	237.3	-35.98	34.20	5.8	21.966
28	28.6	2354.8	-384.2	238.8	-38.96	33.00	5.7	20.434
30	30.6	2434.8	-415.4	246.9	-42.12	31.72	5.5	18.847
32	32.7	2451.6	-404.3	248.6	-41.00	28.83	5.2	17.306
34	34.7	2334.8	-338.8	236.8	-34.35	24.26	4.8	15.863
35	35.7	2115.1	-249.5	214.5	-25.30	20.23	4.6	15.190
36	36.8	2056.1	-250.3	208.5	-25.38	19.76	4.7	14.515
37	37.8	1455.6	-158.9	147.6	-16.11	14.92	5.4	13.911
38	38.8	1336.3	-166.0	135.5	-16.84	6.77	5.7	13.308
Absolute	2.0			268.0			(T =	21.3 ms)
	30.6				-42.12		(T =	67.2 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	2718.3	2454.4	2190.4	1926.5	1662.5	1398.5	1134.6	870.6	606.6	342.7
RX	2718.3	2454.4	2190.4	1956.7	1868.0	1820.1	1796.3	1772.6	1749.4	1726.6
RU	2718.3	2454.4	2190.4	1926.5	1662.5	1398.5	1134.6	870.6	606.6	342.7

RAU = 1655.4 (kN); RA2 = 1934.9 (kN)

Current CAPWAP Ru = 1815.8 (kN); Corresponding J(RP)= 0.34; J(RX) = 0.52

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
6.61	20.73	2671.5	2686.5	2686.5	41.271	6.003	6.000	61.0	2579.8

Koepaalutus Zatelliitti; Pile: ZET3 0h — Test: 03-Mar-2015 10:34:
Junttan HHK 5A; Blow: 1886 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

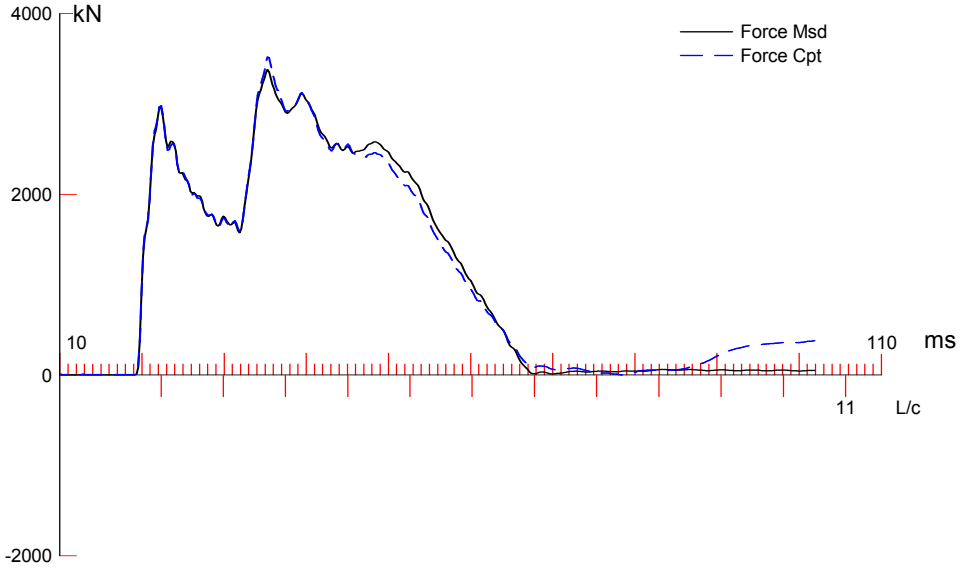
PILE PROFILE AND PILE MODEL

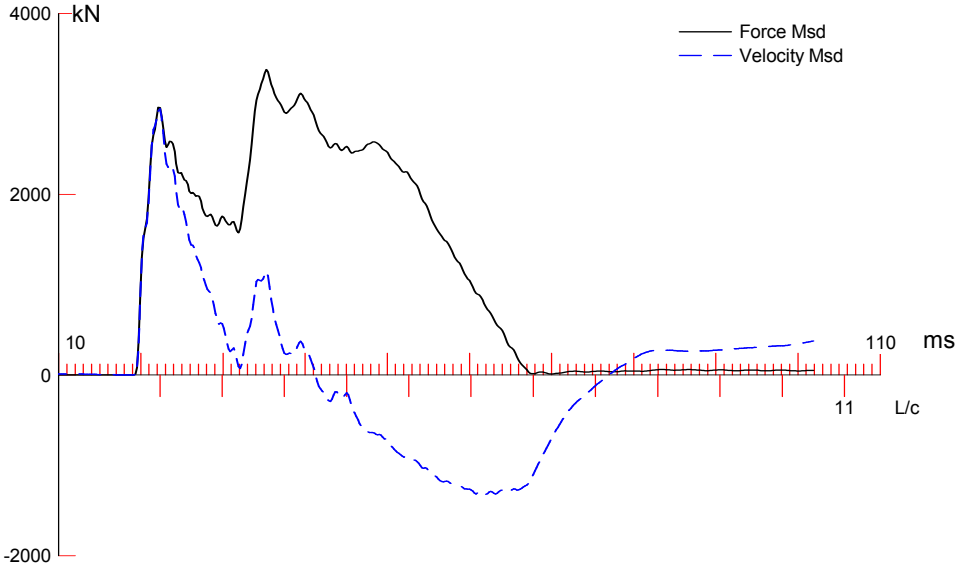
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
38.80	98.61	210000.0	78.500	1.018

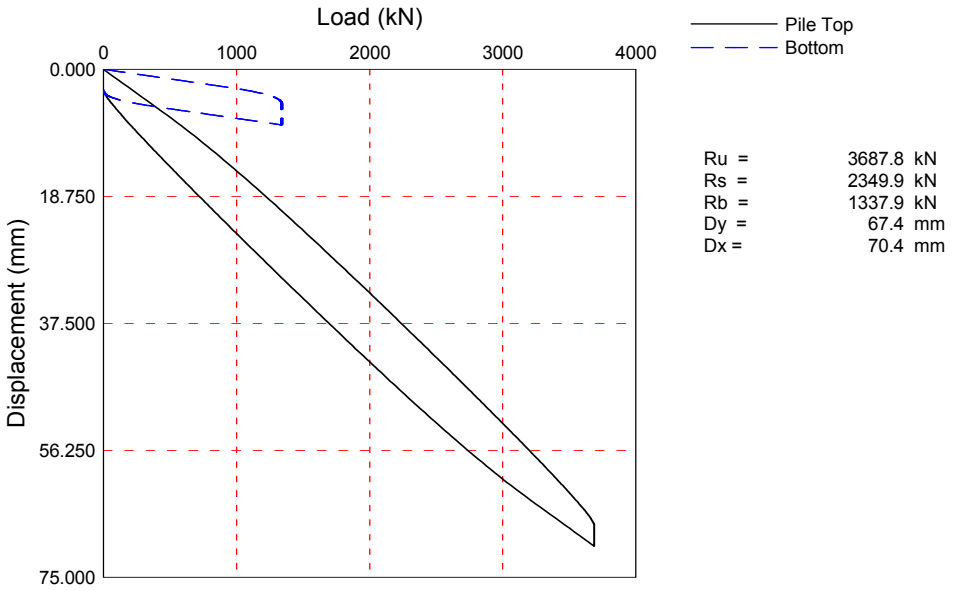
Toe Area 0.082 m^2

Top Segment Length 1.02 m, Top Impedance 404.32 kN/m/s

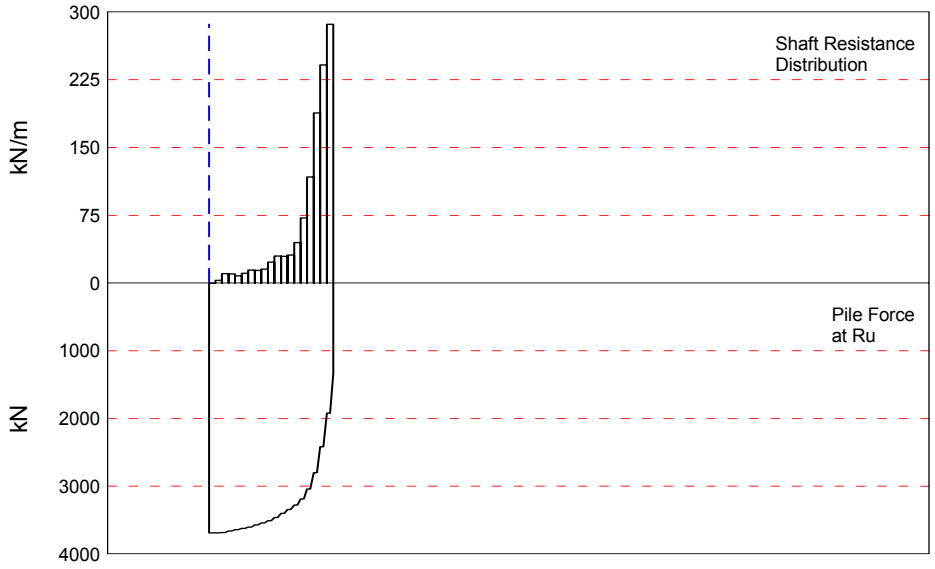
Pile Damping 1.0 %, Time Incr 0.199 ms, Wave Speed 5121.9 m/s, 2L/c 15.2 ms







Ru	=	3687.8 kN
Rs	=	2349.9 kN
Rb	=	1337.9 kN
Dy	=	67.4 mm
Dx	=	70.4 mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Zatelliitin koepaalutus; Pile: ZET3 Test: 31-Mar-2015 17:09:
Vapaapudotusjarkale 9t; Blow: 23 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 3687.8; along Shaft 2349.9; at Toe 1337.9 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m	Quake mm
				3687.8					
1	2.0	2.0	0.0	3687.8	0.0	0.00	0.00	0.000	6.196
2	4.1	4.1	6.1	3681.7	6.1	2.99	2.94	0.862	6.197
3	6.1	6.1	21.6	3660.1	27.7	10.58	10.39	0.862	6.197
4	8.2	8.2	20.8	3639.3	48.5	10.19	10.01	0.862	6.197
5	10.2	10.2	16.7	3622.6	65.2	8.18	8.04	0.862	6.197
6	12.3	12.3	22.4	3600.2	87.6	10.97	10.78	0.862	6.197
7	14.3	14.3	29.4	3570.8	117.0	14.40	14.15	0.862	6.197
8	16.3	16.3	28.7	3542.1	145.7	14.05	13.81	0.862	6.197
9	18.4	18.4	31.7	3510.4	177.4	15.52	15.26	0.862	6.197
10	20.4	20.4	47.3	3463.1	224.7	23.16	22.76	0.862	6.197
11	22.5	22.5	61.0	3402.1	285.7	29.87	29.36	0.862	6.197
12	24.5	24.5	60.5	3341.6	346.2	29.63	29.12	0.862	6.197
13	26.5	26.5	63.3	3278.3	409.5	31.00	30.46	0.862	6.197
14	28.6	28.6	91.9	3186.4	501.4	45.00	44.23	0.862	6.197
15	30.6	30.6	146.9	3039.5	648.3	71.94	70.69	0.862	6.197
16	32.7	32.7	239.7	2799.8	888.0	117.38	115.35	0.862	6.197
17	34.7	34.7	384.3	2415.5	1272.3	188.19	184.94	0.862	6.197
18	36.8	36.8	492.7	1922.8	1765.0	241.27	237.11	0.862	5.687
19	38.8	38.8	584.9	1337.9	2349.9	286.42	281.48	0.862	3.775
Avg. Shaft			123.7			60.56	59.52	0.862	5.487
Toe			1337.9				16237.22	0.394	3.803

Soil Model Parameters/Extensions		Shaft	Toe
Case Damping Factor		5.010	1.304
Damping Type		Smith	
Unloading Quake	(% of loading quake)	100	31
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	11	
Resistance Gap (included in Toe Quake)	(mm)		2.841
Soil Plug Weight	(kN)		0.06

CAPWAP match quality = 2.88 (Wave Up Match) ; RSA = 0
Observed: final set = 3.000 mm; blow count = 333 b/m
Computed: final set = 0.100 mm; blow count = 9999 b/m

max. Top Comp. Stress = 361.4 MPa (T= 35.7 ms, max= 1.012 x Top)
max. Comp. Stress = 365.8 MPa (Z= 6.1 m, T= 36.7 ms)
max. Tens. Stress = -68.88 MPa (Z= 38.8 m, T= 75.0 ms)
max. Energy (EMX) = 129.64 kJ; max. Measured Top Displ. (DMX)=55.64 mm

Zatelliitin koepaalutus; Pile: ZET3 Test: 31-Mar-2015 17:09:
Vapaapudotusjarkale 9t; Blow: 23 CAPWAP(R) 2006-2
Inspecta OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3563.6	-11.1	361.4	-1.13	129.64	7.2	53.421
2	2.0	3587.2	-24.5	363.8	-2.48	127.77	7.2	52.057
4	4.1	3606.8	-74.7	365.7	-7.58	123.99	7.0	49.322
6	6.1	3607.2	-159.2	365.8	-16.15	118.95	6.8	46.585
8	8.2	3572.0	-234.6	362.2	-23.79	111.06	6.7	43.856
10	10.2	3525.9	-292.0	357.5	-29.61	103.58	6.5	41.127
12	12.3	3486.9	-342.1	353.6	-34.69	96.95	6.3	38.360
14	14.3	3433.4	-386.2	348.2	-39.16	89.54	6.1	35.545
16	16.3	3363.5	-433.0	341.1	-43.90	81.37	5.8	32.680
18	18.4	3307.3	-478.5	335.4	-48.52	73.61	5.5	29.782
20	20.4	3251.0	-526.0	329.7	-53.34	65.89	5.2	26.867
22	22.5	3166.6	-567.5	321.1	-57.54	57.26	4.8	23.960
24	24.5	3065.9	-594.2	310.9	-60.25	48.36	4.4	21.094
26	26.5	3004.1	-626.5	304.6	-63.53	40.53	4.0	18.284
28	28.6	2966.7	-657.6	300.8	-66.69	33.54	3.7	15.527
30	30.6	2883.5	-662.9	292.4	-67.22	26.56	3.2	12.845
32	32.7	2733.3	-668.0	277.2	-67.74	19.69	3.0	10.283
34	34.7	2503.4	-668.1	253.9	-67.75	13.36	2.8	7.901
35	35.7	2189.4	-673.8	222.0	-68.33	9.95	2.8	6.825
36	36.8	2210.6	-674.2	224.2	-68.37	9.94	2.6	5.745
37	37.8	1942.6	-678.4	197.0	-68.79	8.60	2.4	4.782
38	38.8	1949.1	-679.3	197.7	-68.88	7.78	2.1	3.822
Absolute	6.1			365.8			(T =	36.7 ms)
	38.8				-68.88		(T =	75.0 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	2951.2	2897.7	2844.1	2790.6	2737.1	2683.6	2630.0	2576.5	2523.0	2469.5
RX	4312.8	4148.5	3984.3	3820.1	3655.8	3516.8	3448.2	3379.5	3310.9	3254.6
RU	2951.2	2897.7	2844.1	2790.6	2737.1	2683.6	2630.0	2576.5	2523.0	2469.5

RAU = 2808.3 (kN); RA2 = 3260.6 (kN)

Current CAPWAP Ru = 3687.8 (kN); Corresponding J(RP)= 0.00; J(RX) = 0.38

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
7.35	22.53	1719.0	1767.4	3389.1	55.641	3.041	3.000	133.3	4547.8

PILE PROFILE AND PILE MODEL

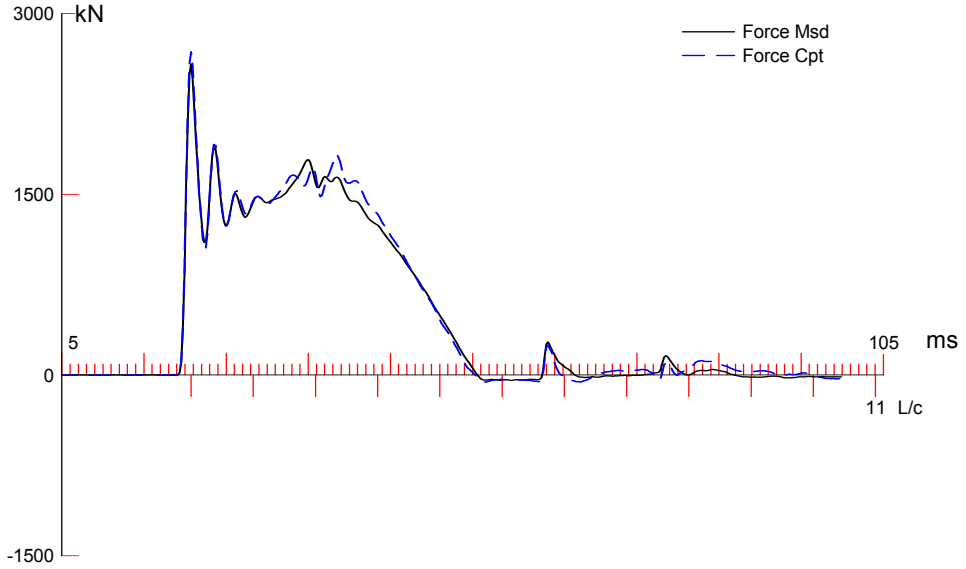
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
38.80	98.61	210000.0	78.500	1.018

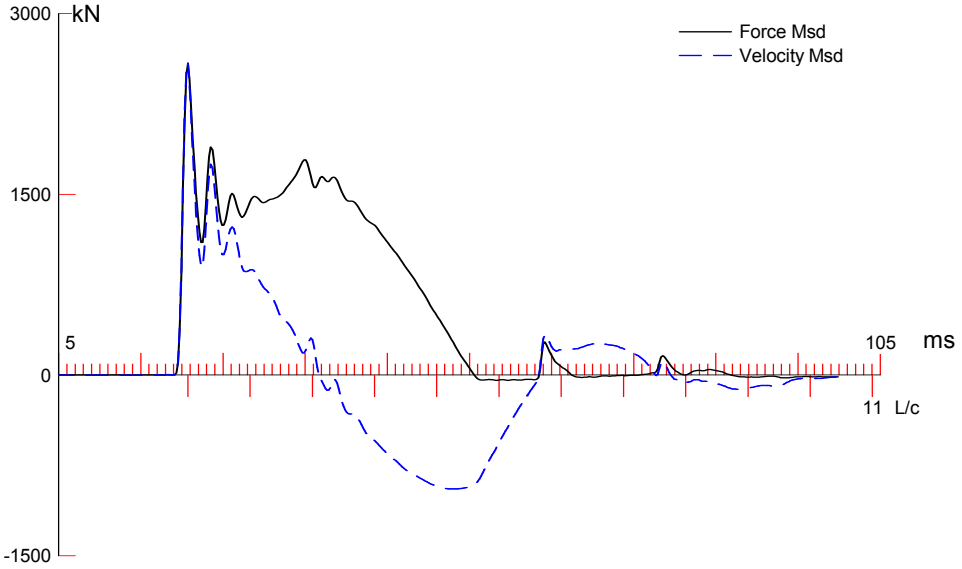
Zatelliitin koepaalutus; Pile: ZET3 Test: 31-Mar-2015 17:09:
Vapaapudotusjarkale 9t; Blow: 23 CAPWAP(R) 2006-2
Inspecta OP: TRe

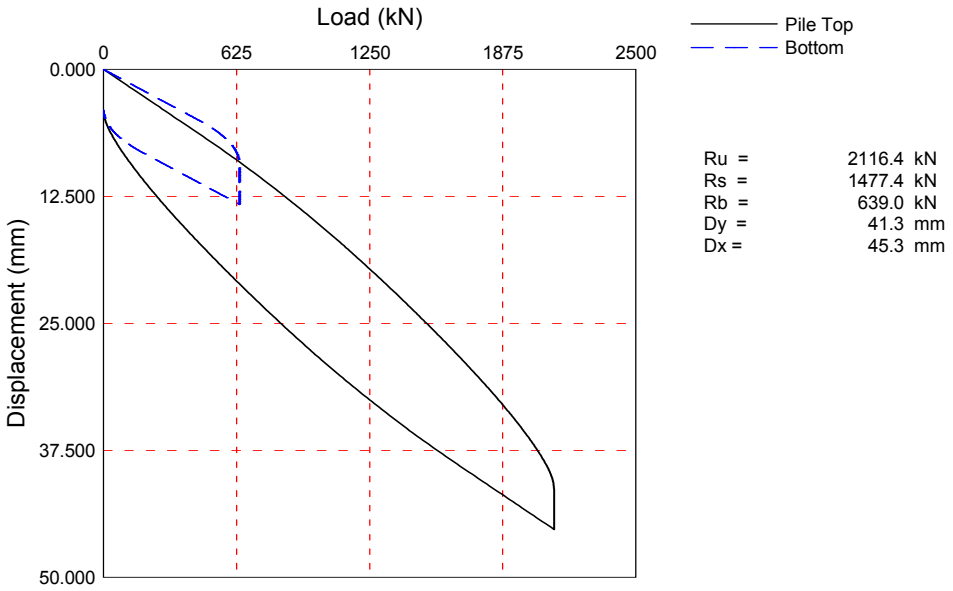
Toe Area 0.082 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.02	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.04	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.01
3	3.06	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.01
38	38.80	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.01

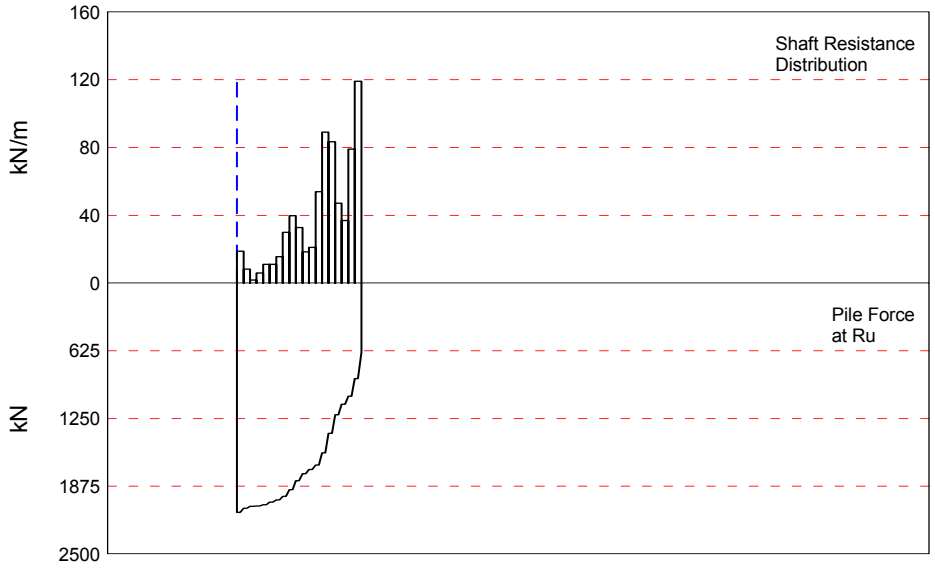
Pile Damping 1.0 %, Time Incr 0.199 ms, Wave Speed 5121.9 m/s, 2L/c 15.2 ms







Ru = 2116.4 kN
Rs = 1477.4 kN
Rb = 639.0 kN
Dy = 41.3 mm
Dx = 45.3 mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Koepaalutus Zatelliitti; Pile: ZET3 Test: 04-Mar-2015 16:16:
Junttan HHK 5A; Blow: 21 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2116.4; along Shaft 1477.4; at Toe 639.0 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m	Quake mm
				2116.4					
1	2.0	1.2	38.4	2078.0	38.4	30.92	30.38	0.264	7.500
2	4.1	3.3	16.9	2061.1	55.3	8.28	8.13	0.264	7.502
3	6.1	5.3	3.9	2057.2	59.2	1.91	1.88	0.264	7.502
4	8.2	7.4	12.2	2045.0	71.4	5.97	5.87	0.264	7.502
5	10.2	9.4	22.6	2022.4	94.0	11.07	10.88	0.264	7.502
6	12.3	11.5	22.6	1999.8	116.6	11.07	10.88	0.264	7.502
7	14.3	13.5	32.0	1967.8	148.6	15.67	15.40	0.264	7.502
8	16.3	15.5	61.2	1906.6	209.8	29.97	29.45	0.264	7.502
9	18.4	17.6	81.4	1825.2	291.2	39.86	39.17	0.264	7.502
10	20.4	19.6	67.0	1758.2	358.2	32.81	32.24	0.264	7.502
11	22.5	21.7	37.5	1720.7	395.7	18.36	18.05	0.264	7.502
12	24.5	23.7	43.1	1677.6	438.8	21.11	20.74	0.264	7.502
13	26.5	25.7	110.0	1567.6	548.8	53.87	52.94	0.264	7.502
14	28.6	27.8	181.8	1385.8	730.6	89.03	87.49	0.264	7.502
15	30.6	29.8	170.2	1215.6	900.8	83.35	81.91	0.264	7.502
16	32.7	31.9	96.2	1119.4	997.0	47.11	46.30	0.264	7.502
17	34.7	33.9	75.6	1043.8	1072.6	37.02	36.38	0.264	7.502
18	36.8	36.0	161.5	882.3	1234.1	79.09	77.72	0.264	7.502
19	38.8	38.0	243.3	639.0	1477.4	119.14	117.09	0.264	6.447
Avg. Shaft			77.8			38.88	38.21	0.264	7.328
Toe			639.0				7755.13	0.423	7.150

Soil Model Parameters/Extensions		Shaft	Toe
Case Damping Factor		0.965	0.669
Unloading Quake	(% of loading quake)	161	78
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	78	
Soil Support Dashpot		2.164	9.049
Soil Support Weight	(kN)	10.39	10.39

CAPWAP match quality = 2.00 (Force Match) ; RSA = 0
Observed: final set = 4.000 mm; blow count = 250 b/m
Computed: final set = 3.746 mm; blow count = 267 b/m

max. Top Comp. Stress = 272.1 MPa (T= 20.9 ms, max= 1.014 x Top)
max. Comp. Stress = 275.9 MPa (Z= 2.0 m, T= 21.3 ms)
max. Tens. Stress = -29.48 MPa (Z= 16.3 m, T= 60.0 ms)
max. Energy (EMX) = 61.51 kJ; max. Measured Top Displ. (DMX)=37.99 mm

Koepaalutus Zatelliitti; Pile: ZET3 Test: 04-Mar-2015 16:16:
Junttan HHK 5A; Blow: 21 CAPWAP(R) 2006-2
Inspecta OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2682.9	-58.9	272.1	-5.98	61.51	6.3	37.238
2	2.0	2721.0	-106.1	275.9	-10.75	61.35	6.3	36.439
4	4.1	2657.1	-107.2	269.4	-10.88	57.53	6.3	34.729
6	6.1	2626.1	-141.1	266.3	-14.30	54.86	6.2	32.910
8	8.2	2627.3	-189.4	266.4	-19.20	53.03	6.2	31.132
10	10.2	2617.8	-226.8	265.5	-22.99	50.74	6.1	29.332
12	12.3	2587.7	-253.1	262.4	-25.67	48.02	6.1	27.547
14	14.3	2567.3	-277.2	260.3	-28.11	45.48	5.9	25.818
16	16.3	2560.4	-290.7	259.6	-29.48	42.57	5.8	24.045
18	18.4	2519.1	-275.0	255.4	-27.89	38.74	5.6	22.287
20	20.4	2425.9	-248.0	246.0	-25.15	34.66	5.5	20.633
22	22.5	2343.4	-240.4	237.6	-24.38	31.33	5.4	19.035
24	24.5	2329.7	-256.5	236.2	-26.01	29.01	5.3	17.452
26	26.5	2355.4	-259.6	238.9	-26.32	26.75	5.0	15.923
28	28.6	2306.1	-236.6	233.8	-24.00	23.40	4.7	14.501
30	30.6	2139.1	-194.3	216.9	-19.70	19.36	4.5	13.237
32	32.7	1959.7	-167.9	198.7	-17.03	16.05	4.3	12.132
34	34.7	1884.3	-169.7	191.1	-17.21	14.15	4.2	11.124
35	35.7	1826.2	-176.0	185.2	-17.85	12.98	4.1	10.663
36	36.8	1822.8	-180.3	184.8	-18.28	12.78	4.1	10.205
37	37.8	1547.3	-181.6	156.9	-18.42	10.89	4.2	9.843
38	38.8	1550.0	-184.6	157.2	-18.72	8.95	4.2	9.479
Absolute	2.0			275.9			(T =	21.3 ms)
	16.3				-29.48		(T =	60.0 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3260.7	3063.7	2866.7	2669.7	2472.7	2275.7	2078.7	1881.6	1684.6	1487.6
RX	3260.7	3063.7	2866.7	2669.7	2472.7	2275.7	2078.7	1972.9	1874.4	1814.5
RU	3260.7	3063.7	2866.7	2669.7	2472.7	2275.7	2078.7	1881.6	1684.6	1487.6

RAU = 59.2 (kN); RA2 = 1910.6 (kN)

Current CAPWAP Ru = 2116.4 (kN); Corresponding J(RP)= 0.58; J(RX) = 0.58

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
6.49	20.93	2622.3	2608.5	2608.5	37.993	3.993	4.000	61.9	2946.2

PILE PROFILE AND PILE MODEL

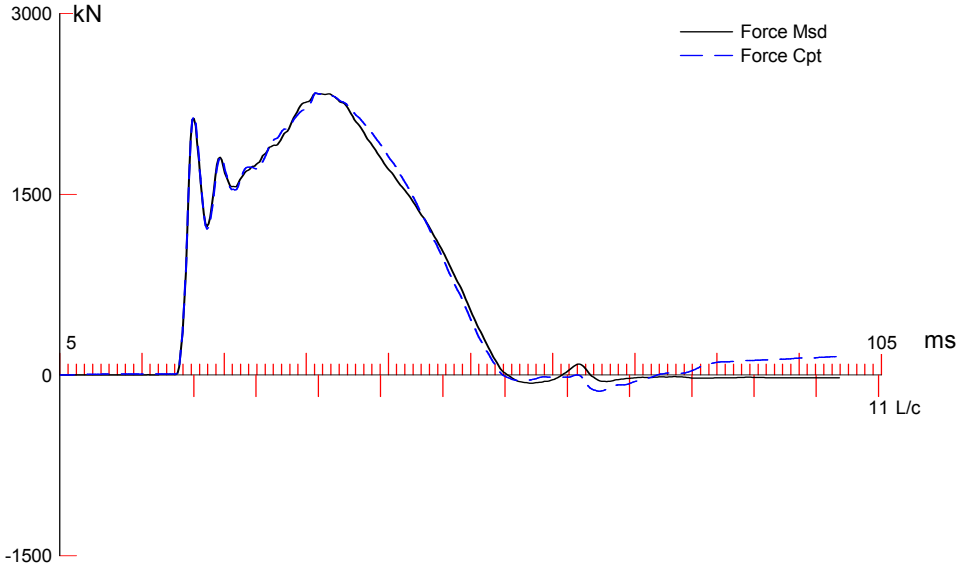
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
38.80	98.61	210000.0	78.500	1.018

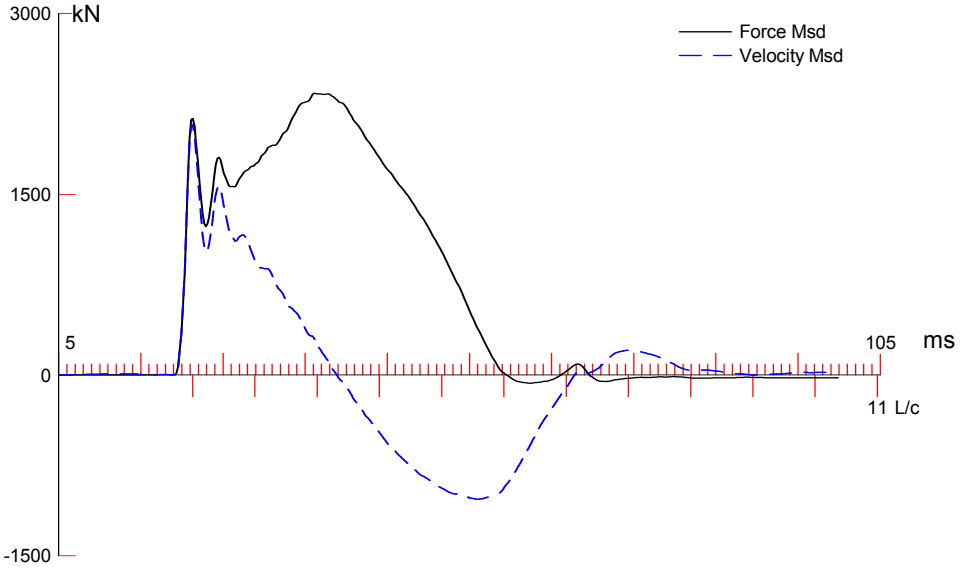
Koepaalutus Zatelliitti; Pile: ZET3 Test: 04-Mar-2015 16:16:
Junttan HHK 5A; Blow: 21 CAPWAP(R) 2006-2
Inspecta OP: TRe

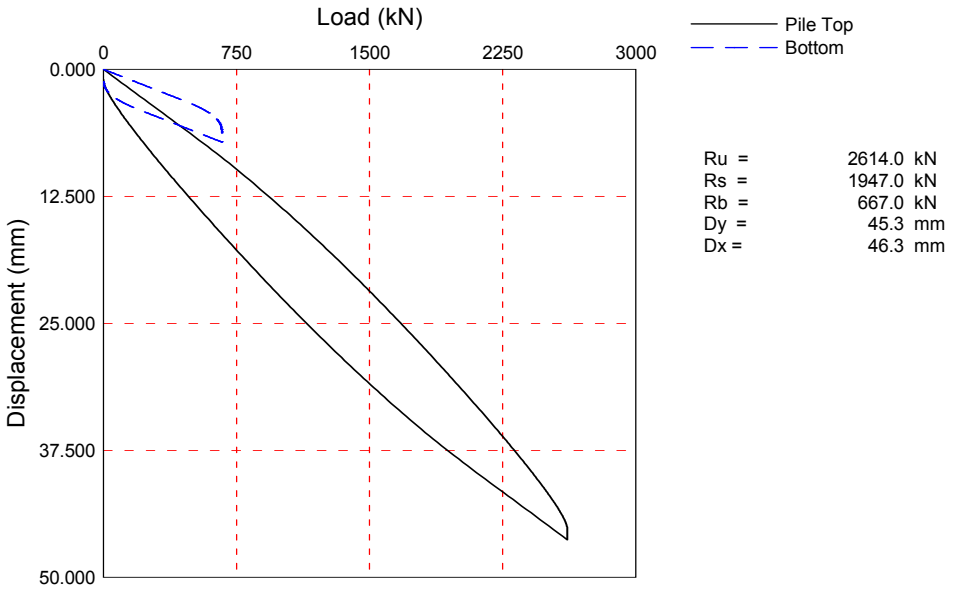
Toe Area 0.082 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.02	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.04	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.04
3	3.06	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.03
38	38.80	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.03

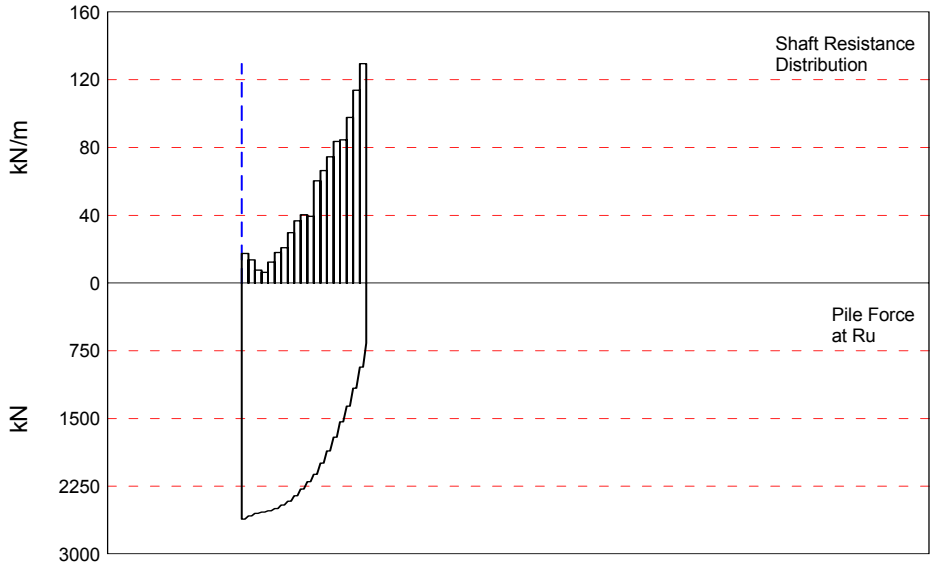
Pile Damping 1.0 %, Time Incr 0.199 ms, Wave Speed 5121.9 m/s, 2L/c 15.2 ms







Ru =	2614.0	kN
Rs =	1947.0	kN
Rb =	667.0	kN
Dy =	45.3	mm
Dx =	46.3	mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Zatelliitin koepaalutus 14vrk; Pile: ZET3 14 vrk Test: 18-Mar-2015 12:33:
Junttan HHK 7A; Blow: 6 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2614.0; along Shaft 1947.0; at Toe 667.0 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m	Quake mm
				2614.0					
1	2.0	2.0	35.9	2578.1	35.9	17.58	17.28	0.338	7.500
2	4.1	4.1	27.8	2550.3	63.7	13.61	13.38	0.338	7.501
3	6.1	6.1	15.7	2534.6	79.4	7.69	7.56	0.338	7.501
4	8.2	8.2	12.9	2521.7	92.3	6.32	6.21	0.338	7.501
5	10.2	10.2	25.4	2496.3	117.7	12.44	12.22	0.338	7.501
6	12.3	12.3	36.8	2459.5	154.5	18.02	17.71	0.338	7.501
7	14.3	14.3	42.7	2416.8	197.2	20.91	20.55	0.338	7.501
8	16.3	16.3	60.6	2356.2	257.8	29.68	29.16	0.338	7.501
9	18.4	18.4	75.1	2281.1	332.9	36.78	36.14	0.338	7.501
10	20.4	20.4	82.4	2198.7	415.3	40.35	39.65	0.338	7.501
11	22.5	22.5	80.4	2118.3	495.7	39.37	38.69	0.338	7.501
12	24.5	24.5	123.5	1994.8	619.2	60.48	59.43	0.338	7.501
13	26.5	26.5	135.5	1859.3	754.7	66.35	65.21	0.338	7.501
14	28.6	28.6	152.1	1707.2	906.8	74.48	73.20	0.338	7.501
15	30.6	30.6	170.6	1536.6	1077.4	83.54	82.10	0.338	7.501
16	32.7	32.7	172.8	1363.8	1250.2	84.62	83.16	0.338	7.501
17	34.7	34.7	199.7	1164.1	1449.9	97.79	96.10	0.338	6.594
18	36.8	36.8	232.5	931.6	1682.4	113.85	111.89	0.338	5.425
19	38.8	38.8	264.6	667.0	1947.0	129.57	127.34	0.338	4.447
Avg. Shaft			102.5			50.18	49.31	0.338	6.745
Toe			667.0				8094.95	0.614	4.546

Soil Model Parameters/Extensions		Shaft	Toe
Case Damping Factor		1.628	1.013
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	18	
Resistance Gap (included in Toe Quake)	(mm)		0.002
Soil Plug Weight	(kN)		0.28

CAPWAP match quality = 1.78 (Force Match) ; RSA = 0
Observed: final set = 1.000 mm; blow count = 1000 b/m
Computed: final set = 0.100 mm; blow count = 9999 b/m

max. Top Comp. Stress = 237.5 MPa (T= 36.3 ms, max= 1.023 x Top)
max. Comp. Stress = 243.0 MPa (Z= 10.2 m, T= 38.3 ms)
max. Tens. Stress = -31.65 MPa (Z= 24.5 m, T= 66.0 ms)
max. Energy (EMX) = 70.79 kJ; max. Measured Top Displ. (DMX)=41.41 mm

Zatelliitin koepaalutus 14vrk; Pile: ZET3 14 vrk — Test: 18-Mar-2015 12:33:
Junttan HHK 7A; Blow: 6 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2342.3	-135.2	237.5	-13.71	70.79	5.1	40.278
2	2.0	2387.2	-152.8	242.1	-15.50	69.65	5.0	39.126
4	4.1	2389.5	-165.5	242.3	-16.78	64.46	5.0	36.840
6	6.1	2389.8	-176.5	242.3	-17.90	60.00	4.9	34.557
8	8.2	2394.8	-184.8	242.8	-18.74	56.38	4.9	32.263
10	10.2	2396.6	-219.7	243.0	-22.28	52.98	4.8	29.962
12	12.3	2386.4	-248.8	242.0	-25.23	49.04	4.7	27.667
14	14.3	2361.1	-271.0	239.4	-27.49	44.75	4.6	25.394
16	16.3	2327.7	-291.6	236.0	-29.57	40.47	4.4	23.148
18	18.4	2273.2	-301.5	230.5	-30.57	35.87	4.3	20.950
20	20.4	2205.3	-305.7	223.6	-31.00	31.24	4.1	18.812
22	22.5	2130.4	-309.7	216.0	-31.40	26.88	3.9	16.743
24	24.5	2056.8	-312.1	208.6	-31.65	23.04	3.7	14.744
26	26.5	1940.5	-301.0	196.8	-30.53	18.93	3.4	12.853
28	28.6	1815.3	-288.9	184.1	-29.30	15.28	3.2	11.083
30	30.6	1672.2	-273.9	169.6	-27.78	12.09	2.9	9.448
32	32.7	1515.0	-251.6	153.6	-25.51	9.37	2.7	7.968
34	34.7	1353.4	-222.8	137.2	-22.60	7.25	2.4	6.646
35	35.7	1166.3	-190.7	118.3	-19.34	5.82	2.2	6.075
36	36.8	1238.6	-194.8	125.6	-19.75	5.49	2.1	5.504
37	37.8	1077.6	-158.3	109.3	-16.05	4.28	1.9	5.039
38	38.8	1114.6	-160.7	113.0	-16.29	3.23	1.8	4.575
Absolute	10.2			243.0			(T =	38.3 ms)
	24.5				-31.65		(T =	66.0 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3162.5	3053.2	2943.8	2834.4	2725.1	2615.7	2506.3	2397.0	2287.6	2178.2
RX	3162.5	3053.2	2944.5	2836.9	2729.3	2621.7	2530.4	2477.1	2423.8	2370.5
RU	3162.5	3053.2	2943.8	2834.4	2725.1	2615.7	2506.3	2397.0	2287.6	2178.2

RAU = 2248.0 (kN); RA2 = 2365.3 (kN)

Current CAPWAP Ru = 2614.0 (kN); Corresponding J(RP)= 0.50; J(RX) = 0.51

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
5.18	21.53	2094.0	2162.2	2340.8	41.414	0.999	1.000	72.4	3414.3

PILE PROFILE AND PILE MODEL

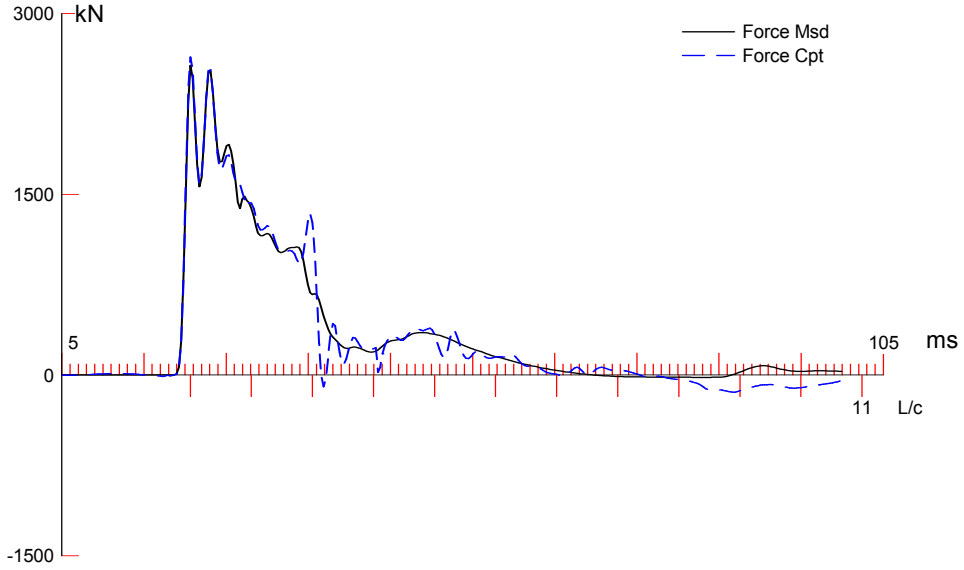
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
38.80	98.61	210000.0	78.500	1.018

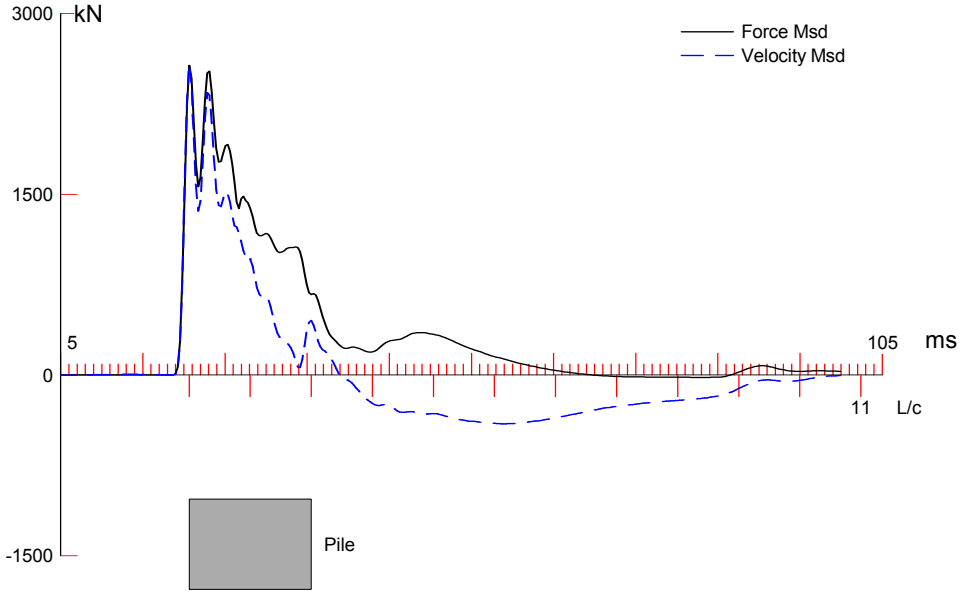
Zatelliitin koepaalutus 14vrk; Pile: ZET3 14 vrk Test: 18-Mar-2015 12:33:
Junttan HHK 7A; Blow: 6 CAPWAP(R) 2006-2
Inspecta OP: TRe

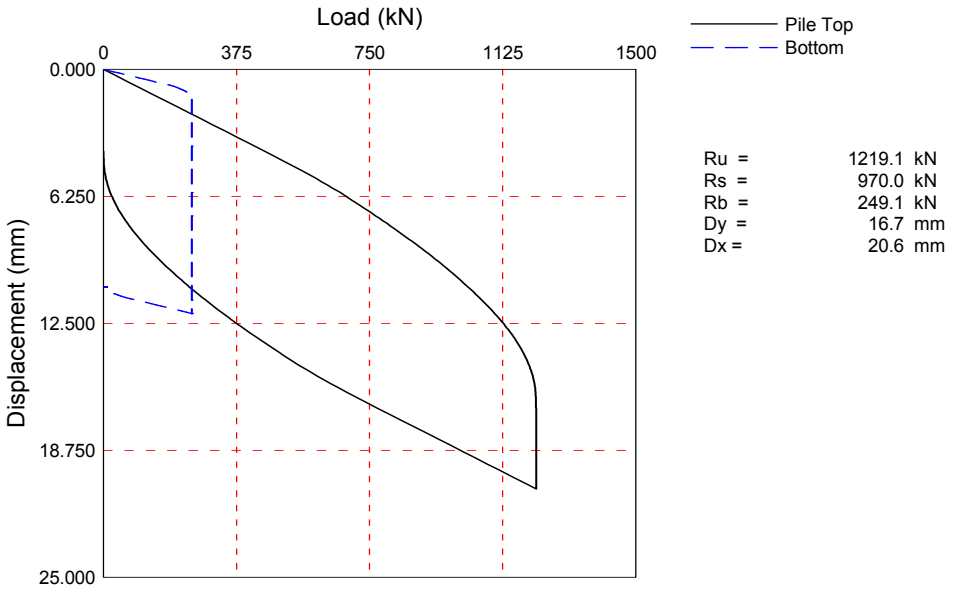
Toe Area 0.082 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.02	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.04	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.01
3	3.06	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.01
38	38.80	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.01

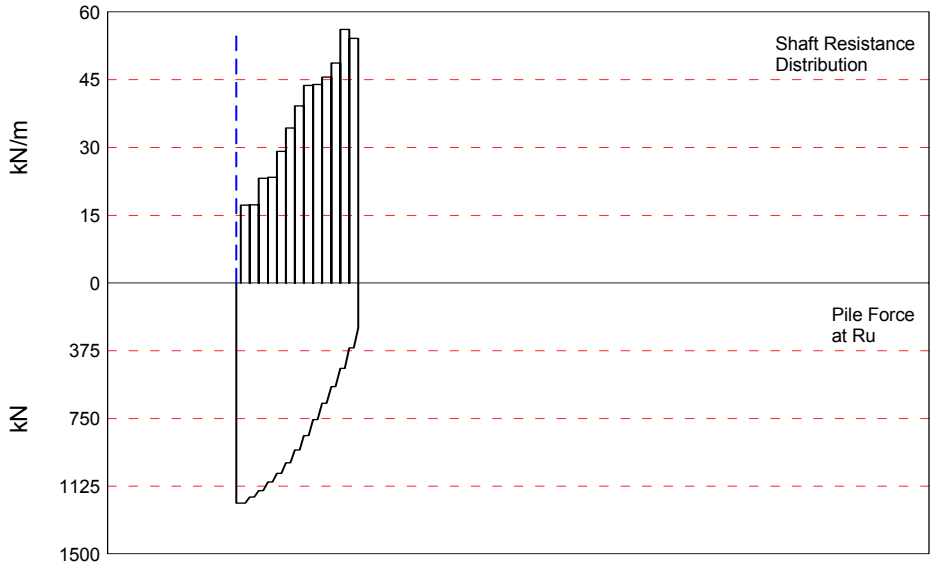
Pile Damping 1.0 %, Time Incr 0.199 ms, Wave Speed 5121.9 m/s, 2L/c 15.2 ms







Ru =	1219.1	kN
Rs =	970.0	kN
Rb =	249.1	kN
Dy =	16.7	mm
Dx =	20.6	mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Koepaalutus Zatelliitti; Pile: ZPB3 24h — Test: 03-Mar-2015 14:24:
Junttan HHK 5A; Blow: 7 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1219.1; along Shaft 970.0; at Toe 249.1 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				1219.1				
1	3.1	2.6	35.1	1184.0	35.1	13.73	11.45	0.452
2	5.1	4.6	35.3	1148.7	70.4	17.33	14.44	0.452
3	7.1	6.6	47.3	1101.4	117.7	23.22	19.35	0.452
4	9.2	8.7	47.7	1053.7	165.4	23.42	19.51	0.452
5	11.2	10.7	59.4	994.3	224.8	29.16	24.30	0.452
6	13.2	12.7	69.9	924.4	294.7	34.31	28.60	0.452
7	15.3	14.8	79.9	844.5	374.6	39.22	32.69	0.452
8	17.3	16.8	89.2	755.3	463.8	43.79	36.49	0.452
9	19.4	18.9	89.6	665.7	553.4	43.99	36.65	0.452
10	21.4	20.9	92.8	572.9	646.2	45.56	37.96	0.452
11	23.4	22.9	99.2	473.7	745.4	48.70	40.58	0.452
12	25.5	25.0	114.3	359.4	859.7	56.11	46.76	0.452
13	27.5	27.0	110.3	249.1	970.0	54.15	45.12	0.452
Avg. Shaft			74.6			35.93	29.94	0.452
Toe			249.1				2767.78	1.200

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	6.154	1.046
Case Damping Factor		0.546	0.372
Damping Type		Smith	
Unloading Quake	(% of loading quake)	298	30
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	49	
Resistance Gap (included in Toe Quake)	(mm)		0.042
Soil Plug Weight	(kN)		0.29
Soil Support Dashpot		0.200	3.000
Soil Support Weight	(kN)	12.22	12.22

CAPWAP match quality = 2.99 (Force Match) ; RSA = 0
Observed: final set = 4.000 mm; blow count = 250 b/m
Computed: final set = 4.173 mm; blow count = 240 b/m

max. Top Comp. Stress = 29.3 MPa (T= 20.9 ms, max= 1.029 x Top)
max. Comp. Stress = 30.2 MPa (Z= 2.0 m, T= 21.5 ms)
max. Tens. Stress = -1.83 MPa (Z= 9.2 m, T= 87.0 ms)
max. Energy (EMX) = 37.19 kJ; max. Measured Top Displ. (DMX)=21.51 mm

Koepaalutus Zatelliitti; Pile: ZPB3 24h — Test: 03-Mar-2015 14:24:
Junttan HHK 5A; Blow: 7 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2639.1	-143.4	29.3	-1.59	37.19	3.1	21.464
2	2.0	2714.8	-153.7	30.2	-1.71	37.60	3.1	21.400
4	4.1	2673.0	-155.8	29.7	-1.73	36.49	3.0	21.167
6	6.1	2636.8	-161.0	29.3	-1.79	35.40	3.0	20.957
8	8.1	2642.6	-161.7	29.4	-1.80	34.04	3.0	20.742
10	10.2	2630.4	-162.3	29.2	-1.80	32.71	3.0	20.542
12	12.2	2596.3	-156.4	28.8	-1.74	31.13	3.0	20.342
13	13.2	2590.5	-155.6	28.8	-1.73	31.08	2.9	20.185
14	14.3	2542.6	-145.8	28.3	-1.62	29.35	2.9	20.070
15	15.3	2532.8	-148.5	28.1	-1.65	29.30	2.9	19.934
16	16.3	2507.6	-140.5	27.9	-1.56	27.39	2.9	19.800
17	17.3	2538.4	-142.3	28.2	-1.58	27.35	2.9	19.663
18	18.3	2503.7	-129.3	27.8	-1.44	25.28	2.9	19.544
19	19.4	2524.0	-129.1	28.0	-1.43	25.23	2.8	19.404
20	20.4	2485.3	-116.9	27.6	-1.30	23.39	2.8	19.265
21	21.4	2495.9	-117.7	27.7	-1.31	23.37	2.8	19.115
22	22.4	2448.9	-104.9	27.2	-1.17	21.47	2.8	18.987
23	23.4	2446.9	-104.7	27.2	-1.16	21.47	3.1	18.848
24	24.4	2397.5	-135.0	26.6	-1.50	19.41	3.0	18.729
25	25.5	2380.6	-161.6	26.5	-1.80	19.38	2.8	18.661
26	26.5	1995.8	-139.5	22.2	-1.55	17.08	3.5	18.652
27	27.5	1440.8	-115.6	16.0	-1.28	14.88	3.9	18.617
Absolute	2.0			30.2			(T =	21.5 ms)
	9.2				-1.83		(T =	87.0 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	2727.4	2476.0	2224.5	1973.0	1721.6	1470.1	1218.6	967.1	715.7	464.2
RX	2727.4	2476.0	2225.3	1975.8	1726.3	1476.8	1227.3	977.8	734.2	692.8
RU	2727.4	2476.0	2224.5	1973.0	1721.6	1470.1	1218.6	967.1	715.7	464.2

RAU = 638.4 (kN); RA2 = 1117.6 (kN)

Current CAPWAP Ru = 1219.1 (kN); Corresponding J(RP)= 0.60; J(RX) = 0.60

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
3.27	20.92	2624.0	2618.2	2618.2	21.510	3.961	4.000	37.3	2925.3

PILE PROFILE AND PILE MODEL

Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	900.00	31228.8	25.000	1.200
12.50	900.00	31228.8	25.000	1.200

Koepaalutus Zatelliitti; Pile: ZPB3 24h — Test: 03-Mar-2015 14:24:
Junttan HHK 5A; Blow: 7 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

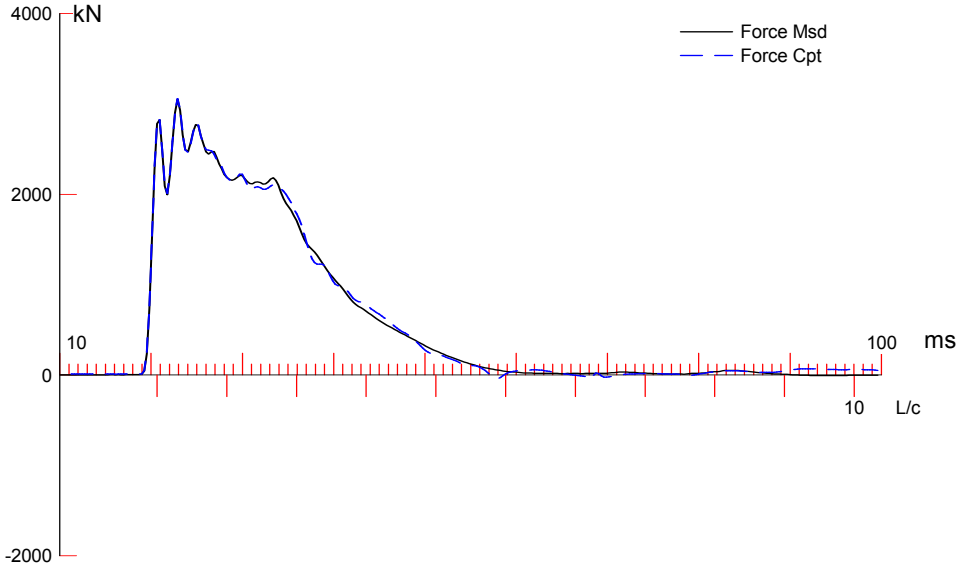
PILE PROFILE AND PILE MODEL

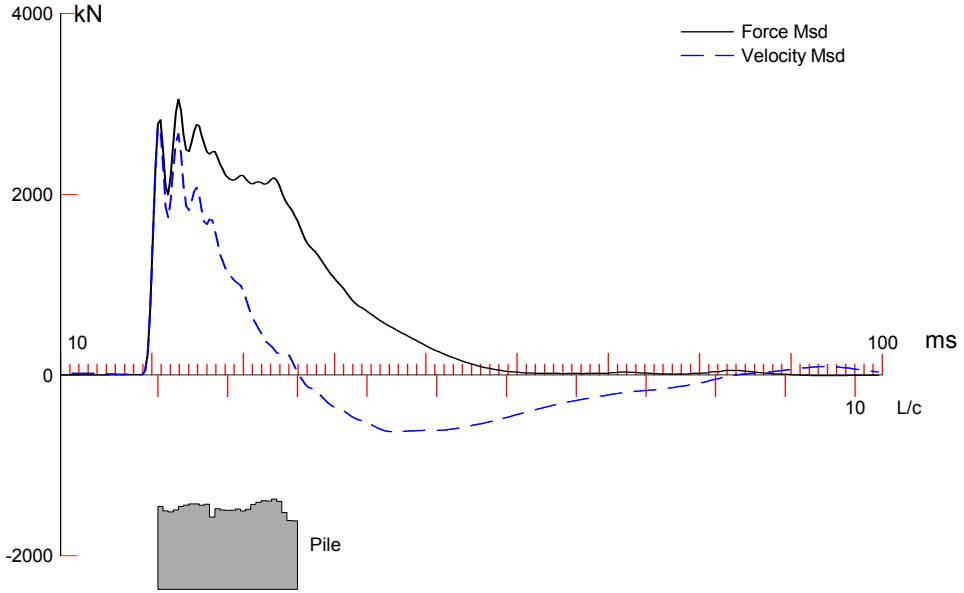
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
12.50	900.00	40000.0	26.000	1.200
12.50	900.00	40000.0	26.000	1.200
12.50	900.00	31228.8	25.000	1.200
27.50	900.00	31228.8	25.000	1.200

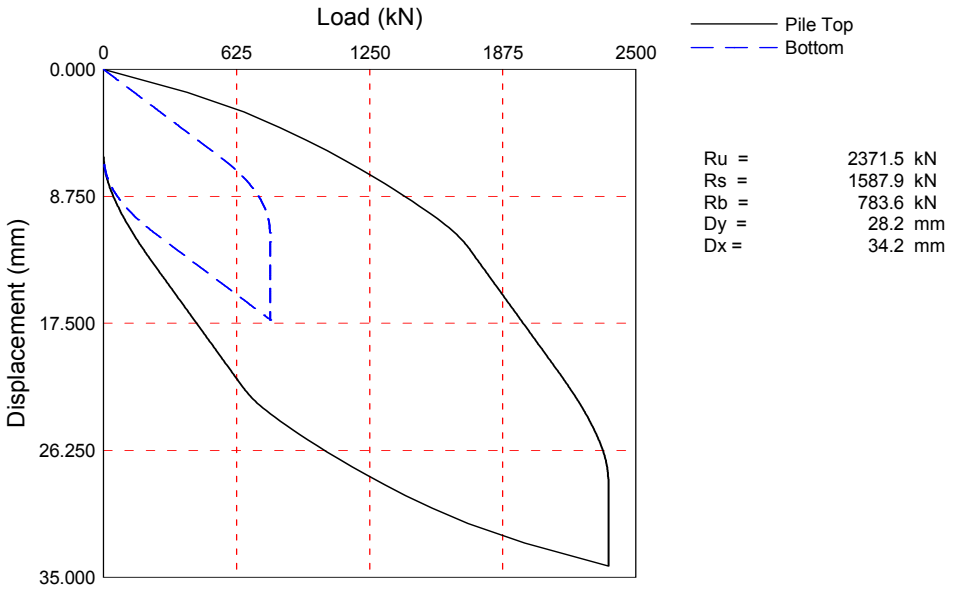
Toe Area 0.090 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.02	803.03	0.00	0.000	0.000	-0.000	0.000	1.200	0.00
2	2.04	803.03	0.00	0.000	0.000	-0.000	0.000	1.200	0.18
3	3.06	803.03	0.00	0.000	0.000	-0.000	0.000	1.200	0.22
12	12.22	803.03	0.00	0.200	1.000	-0.000	0.000	1.200	0.22
13	13.24	803.03	0.00	0.000	0.000	-0.000	0.000	1.200	0.22
27	27.50	803.03	0.00	0.000	0.000	-0.000	0.000	1.200	0.22

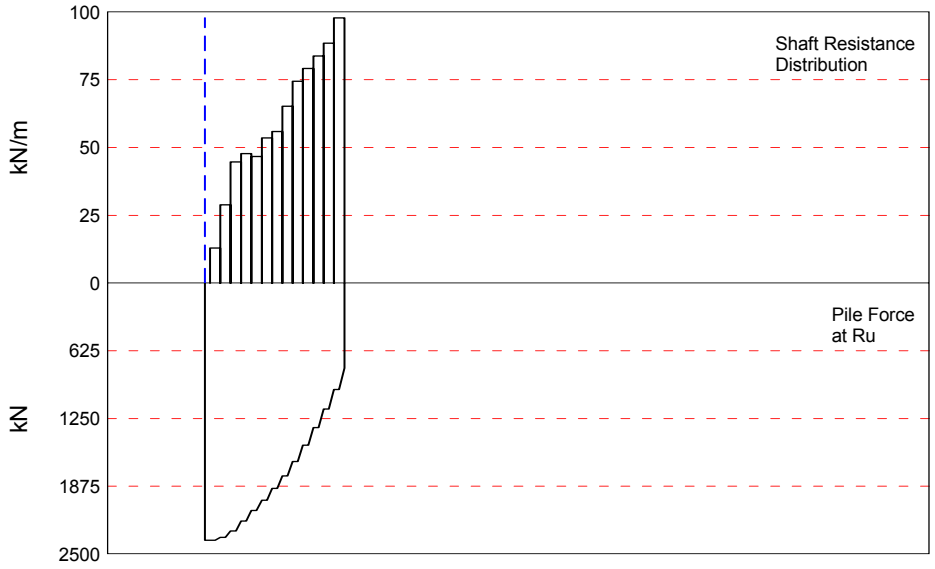
Pile Damping 2.0 %, Time Incr 0.275 ms, Wave Speed 3700.0 m/s, 2L/c 14.9 ms







Ru =	2371.5	kN
Rs =	1587.9	kN
Rb =	783.6	kN
Dy =	28.2	mm
Dx =	34.2	mm



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Zatelliitin koepaalutus 14vrk; Pile: ZPB3 14 vrk — Test: 18-Mar-2015 09:02:
Junttan HHK 7A; Blow: 12 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2371.5; along Shaft 1587.9; at Toe 783.6 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				2371.5				
1	3.1	3.1	26.3	2345.2	26.3	8.61	7.17	0.646
2	5.1	5.1	58.9	2286.3	85.2	28.91	24.10	0.646
3	7.1	7.1	91.0	2195.3	176.2	44.67	37.23	0.646
4	9.2	9.2	97.2	2098.1	273.4	47.72	39.76	0.646
5	11.2	11.2	95.2	2002.9	368.6	46.73	38.95	0.646
6	13.2	13.2	109.1	1893.8	477.7	53.56	44.63	0.646
7	15.3	15.3	113.9	1779.9	591.6	55.91	46.60	0.646
8	17.3	17.3	132.8	1647.1	724.4	65.19	54.33	0.646
9	19.4	19.4	151.8	1495.3	876.2	74.52	62.10	0.646
10	21.4	21.4	161.3	1334.0	1037.5	79.18	65.99	0.646
11	23.4	23.4	170.8	1163.2	1208.3	83.85	69.87	0.646
12	25.5	25.5	180.3	982.9	1388.6	88.51	73.76	0.646
13	27.5	27.5	199.3	783.6	1587.9	97.84	81.53	0.646
Avg. Shaft			122.1			57.74	48.12	0.646
Toe			783.6				8706.67	0.248

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	1.005	8.632
Case Damping Factor		1.242	0.235
Damping Type		Smith	
Unloading Quake	(% of loading quake)	30	69
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	6	
Resistance Gap (included in Toe Quake)	(mm)		1.319
Soil Plug Weight	(kN)		0.67
Soil Support Dashpot		1.045	3.372
Soil Support Weight	(kN)	12.22	12.22

CAPWAP match quality = 1.96 (Wave Up Match) ; RSA = 0
Observed: final set = 6.000 mm; blow count = 167 b/m
Computed: final set = 5.034 mm; blow count = 199 b/m

max. Top Comp. Stress = 34.9 MPa (T= 23.5 ms, max= 1.024 x Top)
max. Comp. Stress = 35.7 MPa (Z= 5.1 m, T= 24.6 ms)
max. Tens. Stress = -1.39 MPa (Z= 17.3 m, T= 64.5 ms)
max. Energy (EMX) = 59.88 kJ; max. Measured Top Displ. (DMX)=25.08 mm

Zatelliitin koepaalutus 14vrk; Pile: ZPB3 14 vrk — Test: 18-Mar-2015 09:02:
Junttan HHK 7A; Blow: 12 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3139.8	-39.6	34.9	-0.44	59.88	3.2	24.375
2	2.0	3159.2	-41.2	35.1	-0.46	59.47	3.2	23.846
4	4.1	3191.2	-47.7	35.5	-0.53	57.27	3.1	22.805
6	6.1	3031.0	-59.3	33.7	-0.66	53.79	3.0	21.845
8	8.1	3007.7	-72.0	33.4	-0.80	49.30	2.8	20.919
10	10.2	2810.2	-84.6	31.2	-0.94	44.81	2.8	19.979
12	12.2	2696.8	-107.2	30.0	-1.19	40.67	2.6	18.852
13	13.2	2764.1	-109.3	30.7	-1.21	40.26	2.5	18.341
14	14.3	2630.2	-114.9	29.2	-1.28	36.46	2.4	17.846
15	15.3	2697.1	-118.7	30.0	-1.32	36.05	2.3	17.335
16	16.3	2530.0	-120.3	28.1	-1.34	32.39	2.3	16.855
17	17.3	2598.6	-125.3	28.9	-1.39	32.02	2.1	16.360
18	18.3	2405.3	-121.8	26.7	-1.35	28.29	2.1	15.945
19	19.4	2428.6	-124.2	27.0	-1.38	28.12	1.9	15.635
20	20.4	2149.5	-118.1	23.9	-1.31	24.36	1.9	15.336
21	21.4	2212.1	-118.9	24.6	-1.32	24.20	1.8	15.046
22	22.4	1906.2	-110.5	21.2	-1.23	20.39	1.8	14.775
23	23.4	1779.1	-112.1	19.8	-1.25	20.26	2.0	14.509
24	24.4	1461.9	-103.4	16.2	-1.15	16.50	2.1	14.271
25	25.5	1539.8	-103.0	17.1	-1.14	16.37	1.9	13.995
26	26.5	1189.4	-97.3	13.2	-1.08	12.65	1.9	13.710
27	27.5	1144.6	-103.4	12.7	-1.15	8.82	2.2	13.471
Absolute	5.1			35.7			(T =	24.6 ms)
	17.3				-1.39		(T =	64.5 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3697.4	3492.4	3287.5	3082.6	2877.7	2672.8	2467.9	2263.0	2058.0	1853.1
RX	3697.4	3492.4	3287.5	3082.6	2877.7	2672.8	2467.9	2263.0	2058.6	1854.4
RU	3697.4	3492.4	3287.5	3082.6	2877.7	2672.8	2467.9	2263.0	2058.0	1853.1

RAU = 720.3 (kN); RA2 = 2297.6 (kN)

Current CAPWAP Ru = 2371.5 (kN); Corresponding J(RP)= 0.65; J(RX) = 0.65

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
3.45	20.94	2846.5	2900.0	3079.7	25.077	5.997	6.000	60.5	3896.5

PILE PROFILE AND PILE MODEL

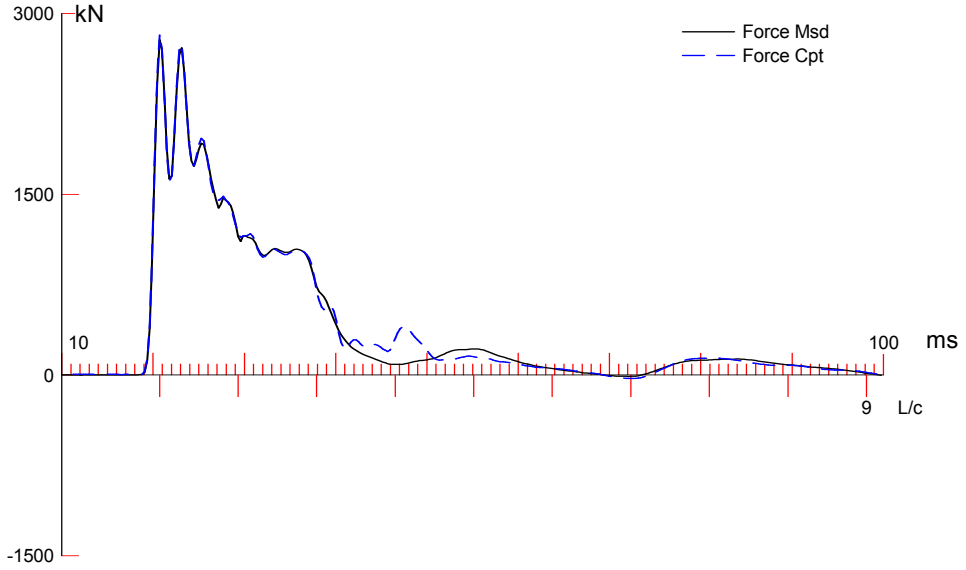
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	900.00	33038.8	25.000	1.200
27.50	900.00	33038.8	25.000	1.200

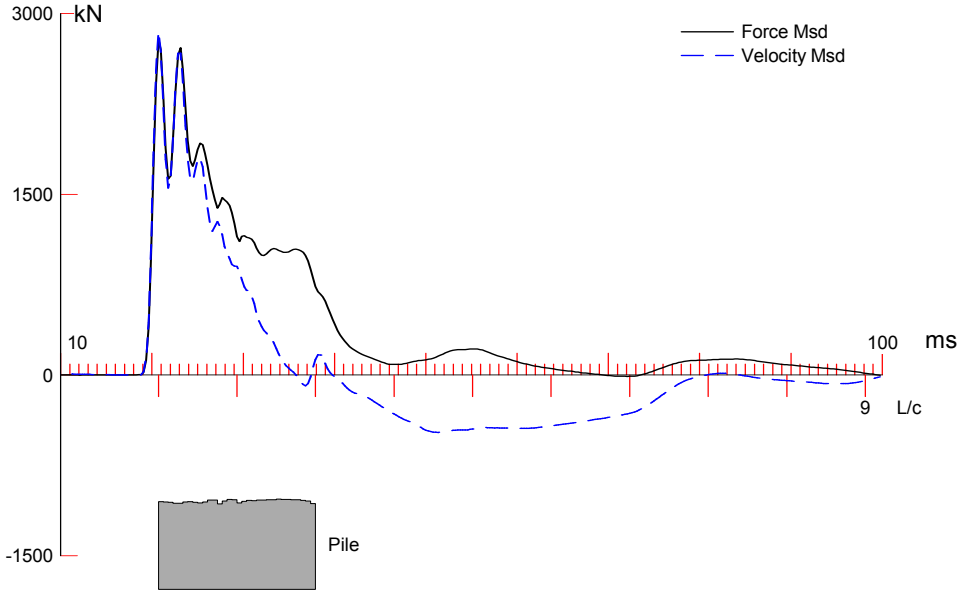
Zatelliitin koepaalutus 14vrk; Pile: ZPB3 14 vrk Test: 18-Mar-2015 09:02:
Junttan HHK 7A; Blow: 12 CAPWAP(R) 2006-2
Inspecta OP: TRe

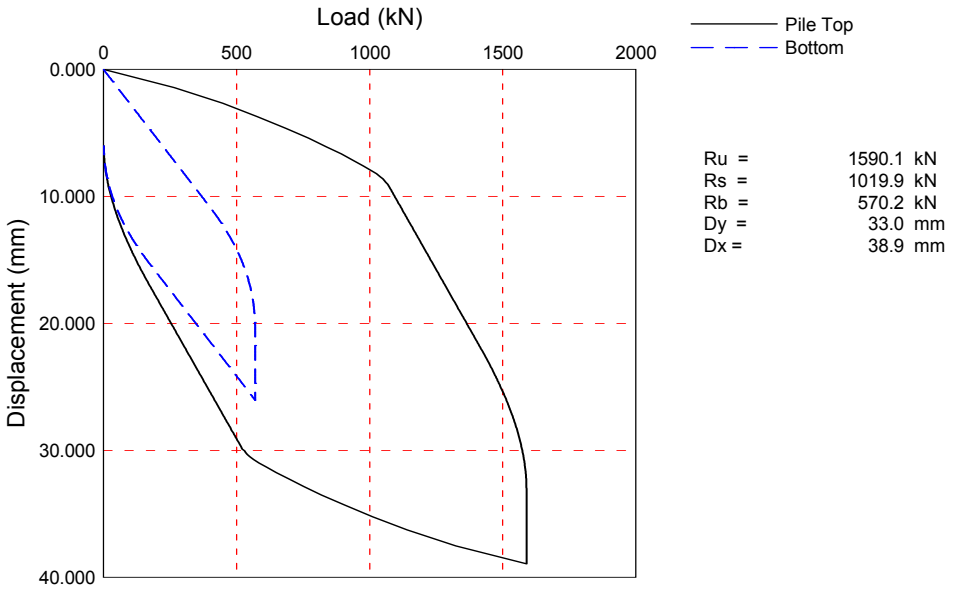
Toe Area 0.090 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.02	825.97	0.00	0.000	0.000	-0.000	0.000	1.200	0.00
2	2.04	784.77	-4.99	0.000	0.000	-0.000	0.000	1.200	0.36
3	3.06	773.17	-6.39	0.000	0.000	-0.000	0.000	1.200	0.36
4	4.07	793.17	-3.97	0.000	0.000	-0.000	0.000	1.200	0.36
5	5.09	827.57	0.19	0.000	0.000	-0.000	0.000	1.200	0.36
6	6.11	841.87	1.93	0.000	0.000	-0.000	0.000	1.200	0.36
7	7.13	853.37	3.32	0.000	0.000	-0.000	0.000	1.200	0.36
8	8.15	853.07	3.28	0.000	0.000	-0.000	0.000	1.200	0.36
9	9.17	841.27	1.85	0.000	0.000	-0.000	0.000	1.200	0.36
10	10.19	851.47	3.09	0.000	0.000	-0.000	1.000	1.200	0.36
11	11.20	722.67	-12.51	0.000	0.000	-0.100	1.000	1.200	0.36
12	12.22	805.97	-2.42	0.000	0.000	-0.000	1.000	1.200	0.36
13	13.24	793.47	-3.93	0.000	0.000	-0.000	0.000	1.200	0.36
14	14.26	788.07	-4.59	0.000	0.000	-0.000	0.000	1.200	0.36
15	15.28	788.17	-4.58	0.000	0.000	-0.000	0.000	1.200	0.36
16	16.30	800.57	-3.08	0.000	0.000	-0.000	0.000	1.200	0.36
17	17.31	782.77	-5.23	0.000	0.000	-0.000	0.000	1.200	0.36
18	18.33	800.47	-3.09	0.000	0.000	-0.000	0.000	1.200	0.36
19	19.35	848.17	2.69	0.000	0.000	-0.000	0.000	1.200	0.36
20	20.37	867.77	5.06	0.000	0.000	-0.000	0.000	1.200	0.36
21	21.39	885.07	7.16	0.000	0.000	-0.000	0.000	1.200	0.36
22	22.41	881.07	6.67	0.000	0.000	-0.000	0.000	1.200	0.36
23	23.43	900.57	9.03	0.000	0.000	-0.000	0.000	1.200	0.36
24	24.44	879.37	6.47	0.000	0.000	-0.000	0.000	1.200	0.36
25	25.46	766.37	-7.22	0.000	0.000	-0.000	0.000	1.200	0.36
26	26.48	686.57	-16.88	0.000	0.000	-0.000	0.000	1.200	0.36
27	27.50	682.97	-17.31	0.000	0.000	-0.000	0.000	1.200	0.36

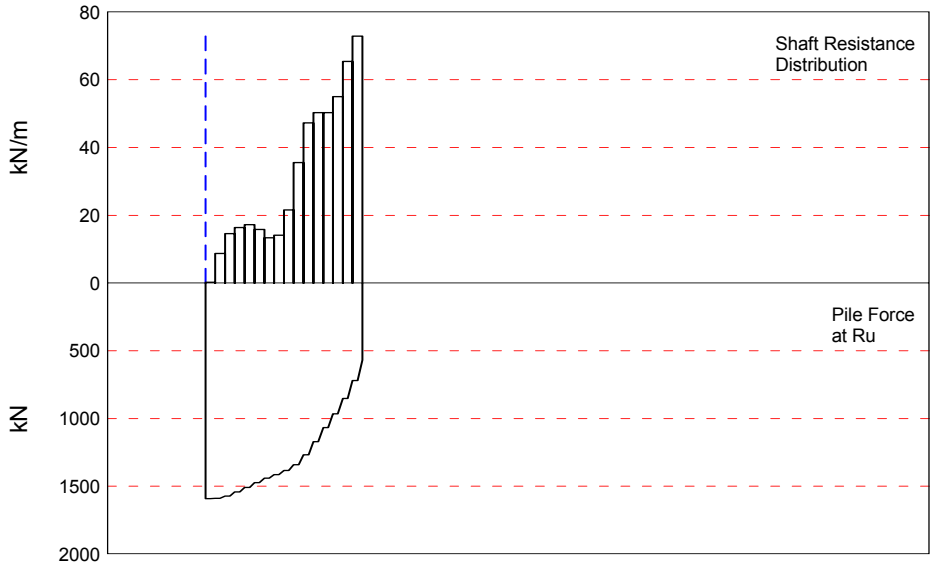
Pile Damping 2.0 %, Time Incr 0.283 ms, Wave Speed 3600.0 m/s, 2L/c 15.3 ms







Ru = 1590.1 kN
Rs = 1019.9 kN
Rb = 570.2 kN
Dy = 33.0 mm
Dx = 38.9 mm



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Koepaalutus Zatelliitti; Pile: ZPB4 24h — Test: 03-Mar-2015 14:46:
Junttan HHK 5A; Blow: 14 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1590.1; along Shaft 1019.9; at Toe 570.2 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				1590.1				
1	2.0	2.0	0.5	1589.6	0.5	0.24	0.00	0.340
2	4.1	4.1	17.9	1571.7	18.4	8.76	0.01	0.340
3	6.1	6.1	29.8	1541.9	48.2	14.58	0.01	0.340
4	8.2	8.2	33.5	1508.4	81.7	16.39	0.01	0.340
5	10.2	10.2	35.2	1473.2	116.9	17.22	0.01	0.340
6	12.3	12.3	32.4	1440.8	149.3	15.85	0.01	0.340
7	14.3	14.3	27.3	1413.5	176.6	13.36	0.01	0.340
8	16.4	16.4	28.9	1384.6	205.5	14.14	0.01	0.340
9	18.4	18.4	44.2	1340.4	249.7	21.63	0.02	0.340
10	20.4	20.4	72.7	1267.7	322.4	35.57	0.03	0.340
11	22.5	22.5	96.7	1171.0	419.1	47.31	0.04	0.340
12	24.5	24.5	102.9	1068.1	522.0	50.35	0.04	0.340
13	26.6	26.6	102.7	965.4	624.7	50.25	0.04	0.340
14	28.6	28.6	112.5	852.9	737.2	55.05	0.05	0.340
15	30.7	30.7	133.7	719.2	870.9	65.42	0.05	0.340
16	32.7	32.7	149.0	570.2	1019.9	72.91	0.06	0.340
Avg. Shaft			63.7			31.19	0.03	0.340
Toe			570.2				6335.56	0.681

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	1.004	15.454
Case Damping Factor		0.398	0.445
Unloading Quake	(% of loading quake)	30	917
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Resistance Gap (included in Toe Quake)	(mm)		14.384
Soil Plug Weight	(kN)		0.10
Soil Support Dashpot		1.500	10.000
Soil Support Weight	(kN)	12262.50	12262.50

CAPWAP match quality = 2.86 (Wave Up Match) ; RSA = 0
Observed: final set = 6.000 mm; blow count = 167 b/m
Computed: final set = 5.099 mm; blow count = 196 b/m

max. Top Comp. Stress = 31.5 MPa (T= 21.2 ms, max= 1.000 x Top)
max. Comp. Stress = 31.5 MPa (Z= 1.0 m, T= 21.2 ms)
max. Tens. Stress = -1.16 MPa (Z= 28.6 m, T= 80.1 ms)
max. Energy (EMX) = 40.11 kJ; max. Measured Top Displ. (DMX)=21.81 mm

Koepaalutus Zatelliitti; Pile: ZPB4 24h — Test: 03-Mar-2015 14:46:
Junttan HHK 5A; Blow: 14 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2832.9	-34.8	31.5	-0.39	40.11	3.2	21.571
2	2.0	2822.0	-40.9	31.4	-0.45	40.08	3.2	21.475
4	4.1	2823.2	-51.0	31.4	-0.57	39.97	3.2	21.209
6	6.1	2809.2	-56.3	31.2	-0.63	39.25	3.1	20.895
8	8.2	2754.5	-59.5	30.6	-0.66	38.17	3.0	20.600
10	10.2	2754.6	-63.2	30.6	-0.70	36.97	3.0	20.259
12	12.3	2688.4	-67.6	29.9	-0.75	35.76	2.9	19.917
14	14.3	2682.7	-73.2	29.8	-0.81	34.63	2.9	19.533
16	16.4	2671.0	-81.0	29.7	-0.90	33.65	2.9	19.118
18	18.4	2697.6	-88.5	30.0	-0.98	32.65	2.8	18.687
20	20.4	2693.8	-94.7	29.9	-1.05	31.22	2.7	18.219
22	22.5	2631.7	-98.5	29.2	-1.09	29.09	2.6	17.759
23	23.5	2503.5	-95.6	27.8	-1.06	26.52	2.5	17.541
24	24.5	2547.5	-100.4	28.3	-1.12	26.41	2.5	17.307
25	25.5	2387.9	-97.5	26.5	-1.08	23.74	2.4	17.079
26	26.6	2354.3	-102.4	26.2	-1.14	23.63	2.4	16.840
27	27.6	2199.6	-99.7	24.4	-1.11	21.02	2.6	16.628
28	28.6	2251.3	-104.4	25.0	-1.16	20.93	2.7	16.407
29	29.6	2074.1	-99.9	23.0	-1.11	18.10	2.6	16.199
30	30.7	2039.9	-102.3	22.7	-1.14	18.00	2.4	15.971
31	31.7	1528.5	-95.0	17.0	-1.06	14.74	2.6	15.762
32	32.7	1357.1	-96.0	15.1	-1.07	11.13	2.7	15.540
Absolute	1.0			31.5			(T =	21.2 ms)
	28.6				-1.16		(T =	80.1 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3161.0	2903.6	2646.1	2388.7	2131.2	1873.8	1616.4	1358.9	1101.5	844.0
RX	3161.0	2903.6	2646.1	2388.7	2131.2	1873.8	1616.4	1358.9	1101.5	844.0
RU	3175.0	2918.9	2662.9	2406.8	2150.8	1894.8	1638.7	1382.7	1126.6	870.6

RAU = 627.8 (kN); RA2 = 1040.7 (kN)

Current CAPWAP Ru = 1590.1 (kN); Corresponding J(RP)= 0.61; J(RX) = 0.61

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
3.32	20.98	2893.4	2842.0	2842.0	21.808	6.001	6.000	40.3	2896.7

PILE PROFILE AND PILE MODEL

Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	900.00	36811.8	25.000	1200.000
32.70	900.00	36811.8	25.000	1200.000

Koepaalutus Zatelliitti; Pile: ZPB4 24h — Test: 03-Mar-2015 14:46:
Junttan HHK 5A; Blow: 14 — CAPWAP(R) 2006-2
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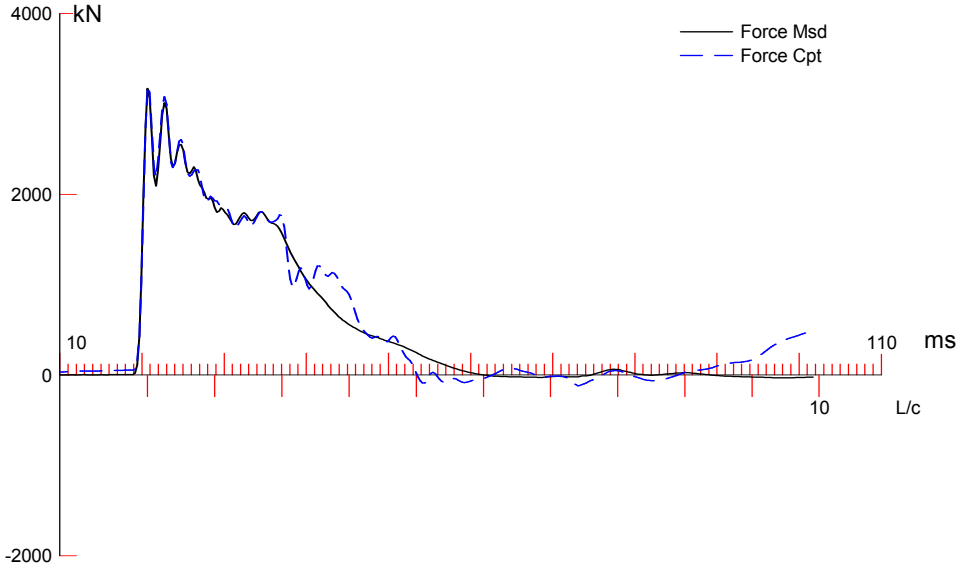
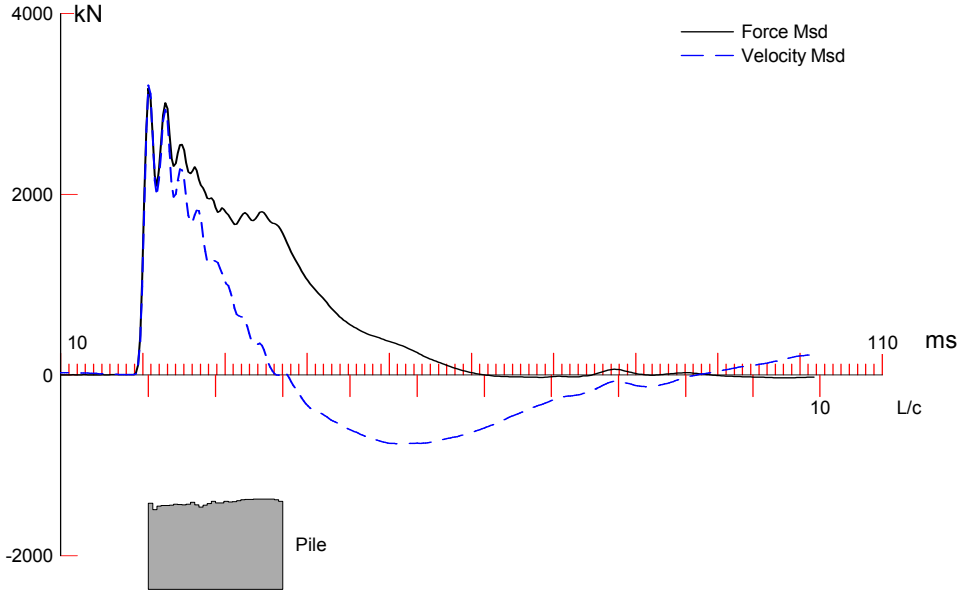
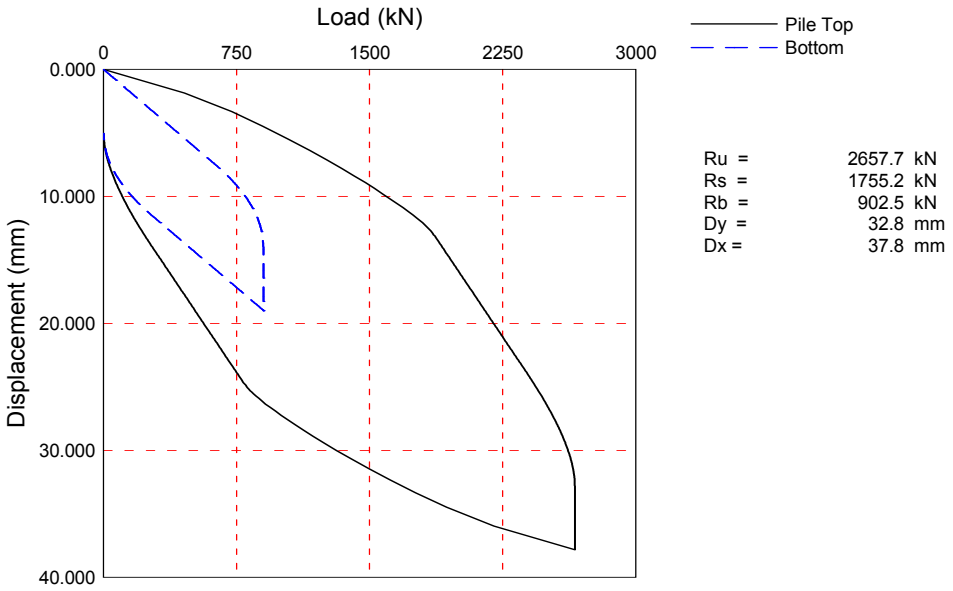
Toe Area 0.090 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.02	871.86	0.00	0.000	0.000	-0.000	0.000	1200.000	0.00
2	2.04	867.56	-0.49	0.000	0.000	-0.000	0.000	1200.000	0.05
3	3.07	866.76	-0.58	0.000	0.000	-0.000	0.000	1200.000	0.05
4	4.09	856.36	-1.78	0.000	0.000	-0.000	0.000	1200.000	0.05
5	5.11	854.86	-1.95	0.000	0.000	-0.000	0.000	1200.000	0.05
6	6.13	869.06	-0.32	0.000	0.000	-0.000	0.000	1200.000	0.05
7	7.15	870.66	-0.14	0.000	0.000	-0.000	0.000	1200.000	0.05
8	8.18	864.46	-0.85	0.000	0.000	-0.000	0.000	1200.000	0.05
9	9.20	857.66	-1.63	0.000	0.000	-0.000	0.000	1200.000	0.05
10	10.22	869.66	-0.25	0.000	0.000	-0.000	0.000	1200.000	0.05
11	11.24	887.96	1.85	0.000	0.000	-0.000	0.000	1200.000	0.05
12	12.26	887.06	1.74	0.000	0.000	-0.000	0.000	1200.000	0.05
13	13.28	848.66	-2.66	0.000	0.000	-0.000	0.000	1200.000	0.05
14	14.31	877.16	0.61	0.000	0.000	-0.000	0.000	1200.000	0.05
15	15.33	892.16	2.33	0.000	0.000	-0.000	0.000	1200.000	0.05
16	16.35	890.46	2.13	0.000	0.000	-0.000	0.000	1200.000	0.05
17	17.37	859.36	-1.43	0.000	0.000	-0.000	0.000	1200.000	0.05
18	18.39	873.96	0.24	0.000	0.000	-0.000	0.000	1200.000	0.05
19	19.42	882.66	1.24	0.000	0.000	-0.000	0.000	1200.000	0.05
20	20.44	881.66	1.12	0.000	0.000	-0.000	0.000	1200.000	0.05
21	21.46	886.56	1.69	0.000	0.000	-0.000	0.000	1200.000	0.05
22	22.48	887.16	1.75	0.000	0.000	-0.000	0.000	1200.000	0.05
23	23.50	889.46	2.02	0.000	0.000	-0.000	0.000	1200.000	0.05
24	24.52	891.56	2.26	0.000	0.000	-0.000	0.000	1200.000	0.05
25	25.55	896.56	2.83	0.000	0.000	-0.000	0.000	1200.000	0.05
26	26.57	894.56	2.60	0.000	0.000	-0.000	0.000	1200.000	0.05
27	27.59	894.66	2.62	0.000	0.000	-0.000	0.000	1200.000	0.05
28	28.61	891.16	2.21	0.000	0.000	-0.000	0.000	1200.000	0.05
29	29.63	891.76	2.28	0.000	0.000	-0.000	0.000	1200.000	0.05
30	30.66	885.86	1.61	0.000	0.000	-0.000	0.000	1200.000	0.05
31	31.68	877.06	0.60	0.000	0.000	-0.000	0.000	1200.000	0.05
32	32.70	851.16	-2.37	0.000	0.000	-0.000	0.000	1200.000	0.05

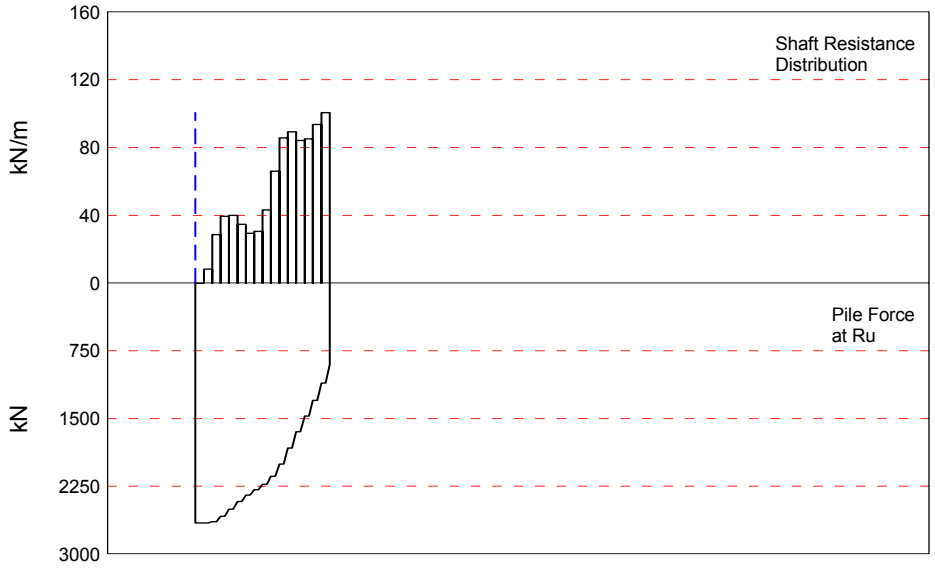
Pile Damping 2.0 %, Time Incr 0.269 ms, Wave Speed 3800.0 m/s, 2L/c 17.2 ms







Ru =	2657.7	kN
Rs =	1755.2	kN
Rb =	902.5	kN
Dy =	32.8	mm
Dx =	37.8	mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Zatelliitin koepaalutus 14vrk; Pile: ZPB4 14 vrk Test: 18-Mar-2015 08:46:
Junttan HHK 7A; Blow: 6 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2657.7; along Shaft 1755.2; at Toe 902.5 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				2657.7				
1	2.0	2.0	0.0	2657.7	0.0	0.00	0.00	0.000
2	4.1	4.1	17.0	2640.7	17.0	8.32	6.93	0.168
3	6.1	6.1	58.5	2582.2	75.5	28.62	23.85	0.168
4	8.2	8.2	80.4	2501.8	155.9	39.34	32.78	0.168
5	10.2	10.2	81.8	2420.0	237.7	40.02	33.35	0.168
6	12.3	12.3	71.0	2349.0	308.7	34.74	28.95	0.168
7	14.3	14.3	60.1	2288.9	368.8	29.41	24.51	0.168
8	16.3	16.3	62.6	2226.3	431.4	30.63	25.52	0.168
9	18.4	18.4	88.3	2138.0	519.7	43.20	36.00	0.168
10	20.4	20.4	135.0	2003.0	654.7	66.06	55.05	0.168
11	22.5	22.5	175.0	1828.0	829.7	85.63	71.36	0.168
12	24.5	24.5	182.6	1645.4	1012.3	89.35	74.45	0.168
13	26.6	26.6	172.2	1473.2	1184.5	84.26	70.21	0.168
14	28.6	28.6	174.1	1299.1	1358.6	85.19	70.99	0.168
15	30.7	30.7	191.2	1107.9	1549.8	93.55	77.96	0.168
16	32.7	32.7	205.4	902.5	1755.2	100.50	83.75	0.168
Avg. Shaft			109.7			53.68	44.73	0.168
Toe			902.5				10027.78	0.584

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	1.004	10.735
Case Damping Factor		0.321	0.574
Unloading Quake	(% of loading quake)	30	55
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Resistance Gap (included in Toe Quake)	(mm)		0.046
Soil Plug Weight	(kN)		0.67
Soil Support Dashpot		0.800	6.927
Soil Support Weight	(kN)	12.26	12.26

CAPWAP match quality = 2.72 (Force Match) ; RSA = 0
Observed: final set = 5.000 mm; blow count = 200 b/m
Computed: final set = 9.405 mm; blow count = 106 b/m

max. Top Comp. Stress = 35.5 MPa (T= 20.9 ms, max= 1.032 x Top)
max. Comp. Stress = 36.7 MPa (Z= 6.1 m, T= 22.7 ms)
max. Tens. Stress = -2.95 MPa (Z= 26.6 m, T= 66.4 ms)
max. Energy (EMX) = 57.50 kJ; max. Measured Top Displ. (DMX)=25.20 mm

Zatelliitin koepaalutus 14vrk; Pile: ZPB4 14 vrk — Test: 18-Mar-2015 08:46:
Junttan HHK 7A; Blow: 6 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3198.0	-117.3	35.5	-1.30	57.50	3.5	24.872
2	2.0	3274.6	-114.9	36.4	-1.28	57.73	3.4	24.520
4	4.1	3254.6	-113.4	36.2	-1.26	57.09	3.3	23.704
6	6.1	3301.9	-112.4	36.7	-1.25	55.97	3.3	22.912
8	8.2	3282.8	-119.6	36.5	-1.33	53.51	3.2	22.033
10	10.2	3211.3	-122.9	35.7	-1.37	50.53	3.2	21.132
12	12.3	3087.9	-134.3	34.3	-1.49	47.64	3.1	20.254
14	14.3	3040.4	-161.2	33.8	-1.79	45.16	3.0	19.383
16	16.3	3000.9	-180.2	33.3	-2.00	42.96	2.9	18.495
18	18.4	3032.1	-194.6	33.7	-2.16	40.95	2.8	17.726
20	20.4	3040.9	-221.1	33.8	-2.46	38.64	2.7	17.069
22	22.5	2977.6	-248.8	33.1	-2.76	35.54	2.6	16.413
23	23.5	2787.2	-248.7	31.0	-2.76	32.14	2.5	16.104
24	24.5	2848.4	-259.6	31.6	-2.88	31.91	2.4	15.773
25	25.5	2651.5	-260.7	29.5	-2.90	28.47	2.4	15.440
26	26.6	2698.0	-265.9	30.0	-2.95	28.34	2.3	15.109
27	27.6	2394.2	-252.7	26.6	-2.81	25.29	2.3	14.824
28	28.6	2448.7	-246.7	27.2	-2.74	25.27	2.4	14.607
29	29.6	2268.0	-249.0	25.2	-2.77	22.33	2.5	14.373
30	30.7	2294.1	-261.1	25.5	-2.90	22.31	2.2	14.130
31	31.7	1927.6	-246.2	21.4	-2.74	19.24	2.4	13.924
32	32.7	1789.4	-238.1	19.9	-2.65	16.41	2.6	13.713
Absolute	6.1			36.7			(T =	22.7 ms)
	26.6				-2.95		(T =	66.4 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3999.3	3744.4	3489.5	3234.6	2979.7	2724.8	2469.9	2214.9	1960.0	1705.1
RX	3999.3	3744.4	3489.5	3234.6	2979.7	2724.8	2469.9	2214.9	1960.0	1705.1
RU	4079.6	3832.7	3585.8	3338.9	3092.0	2845.1	2598.3	2351.4	2104.5	1857.6

RAU = 838.4 (kN); RA2 = 1929.6 (kN)

Current CAPWAP Ru = 2657.7 (kN); Corresponding J(RP)= 0.53; J(RX) = 0.53

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
3.60	20.95	3299.8	3248.6	3248.6	25.199	5.011	5.000	57.7	3819.6

PILE PROFILE AND PILE MODEL

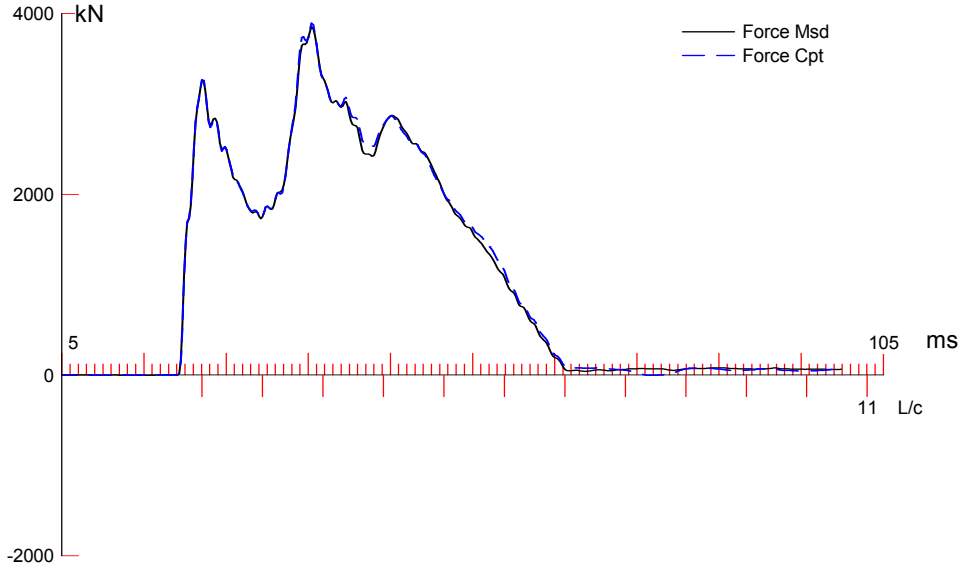
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	900.00	40788.6	25.000	1.200
32.70	900.00	40788.6	25.000	1.200

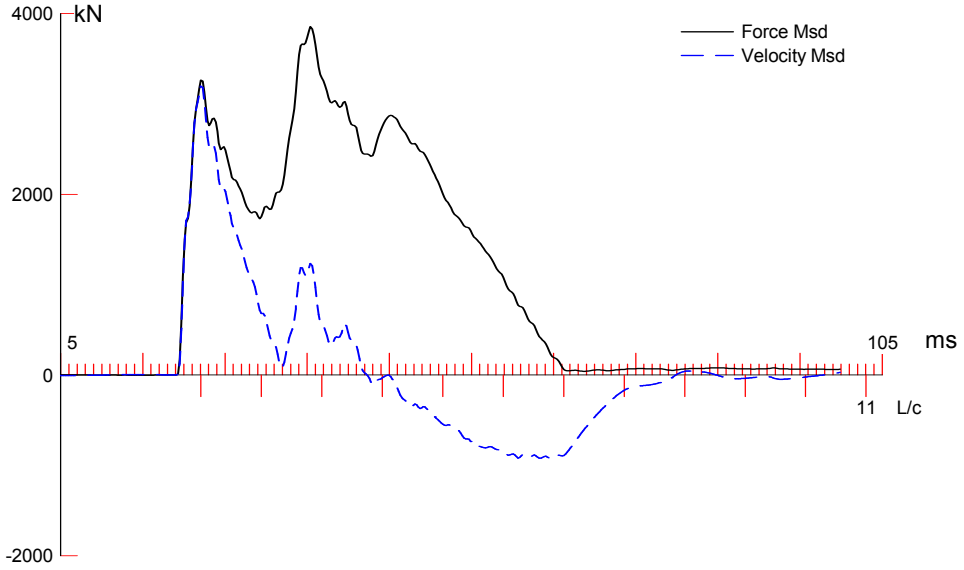
Zatelliitin koepaalutus 14vrk; Pile: ZPB4 14 vrk Test: 18-Mar-2015 08:46:
Junttan HHK 7A; Blow: 6 CAPWAP(R) 2006-2
Inspecta OP: TRe

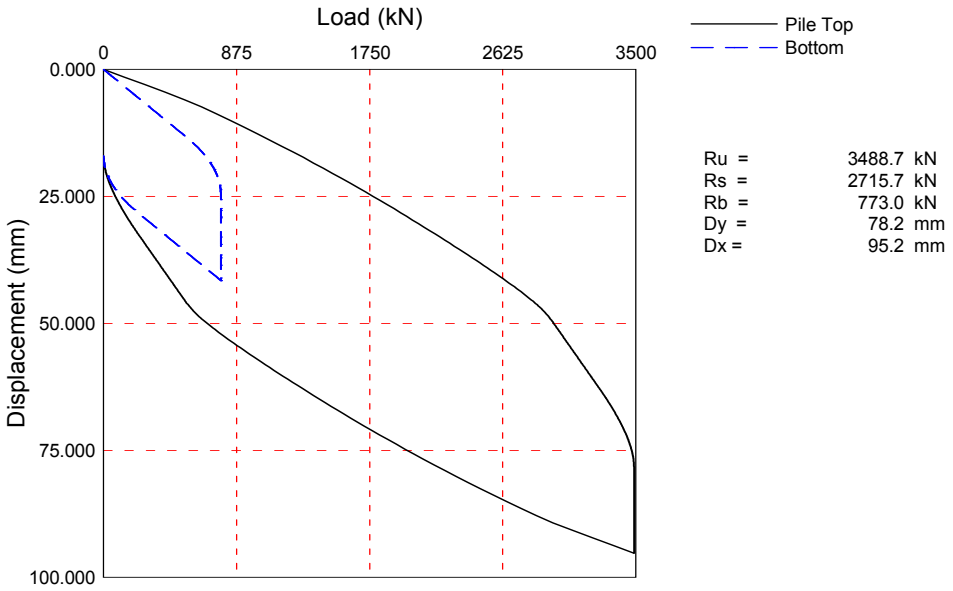
Toe Area 0.090 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.02	917.70	0.00	0.000	0.000	-0.000	0.000	1.200	0.00
2	2.04	849.20	-7.46	0.000	0.000	-0.000	0.000	1.200	0.16
3	3.07	887.10	-3.33	0.000	0.000	-0.000	0.000	1.200	0.17
4	4.09	892.70	-2.72	0.000	0.000	-0.000	0.000	1.200	0.17
5	5.11	891.40	-2.87	0.000	0.000	-0.000	0.000	1.200	0.17
6	6.13	898.00	-2.15	0.000	0.000	-0.000	0.000	1.200	0.17
7	7.15	905.80	-1.30	0.000	0.000	-0.000	0.000	1.200	0.17
8	8.18	903.50	-1.55	0.000	0.000	-0.000	0.000	1.200	0.17
9	9.20	899.50	-1.98	0.000	0.000	-0.000	0.000	1.200	0.17
10	10.22	908.20	-1.04	0.000	0.000	-0.000	0.000	1.200	0.17
11	11.24	926.50	0.96	0.000	0.000	-0.000	0.000	1.200	0.17
12	12.26	901.04	-1.82	0.000	0.000	-0.000	0.000	1.200	0.17
13	13.28	877.04	-4.43	0.000	0.000	-0.000	0.000	1.200	0.17
14	14.31	896.24	-2.34	0.000	0.000	-0.000	0.000	1.200	0.17
15	15.33	913.84	-0.42	0.000	0.000	-0.000	0.000	1.200	0.17
16	16.35	937.70	2.18	0.000	0.000	-0.000	0.000	1.200	0.17
17	17.37	920.50	0.31	0.000	0.000	-0.000	0.000	1.200	0.17
18	18.39	919.20	0.16	0.000	0.000	-0.000	0.000	1.200	0.17
19	19.42	935.90	1.98	0.000	0.000	-0.000	0.000	1.200	0.17
20	20.44	931.30	1.48	0.000	0.000	-0.000	0.000	1.200	0.17
21	21.46	934.40	1.82	0.000	0.000	-0.000	0.000	1.200	0.17
22	22.48	945.10	2.99	0.000	0.000	-0.000	0.000	1.200	0.17
23	23.50	953.80	3.93	0.000	0.000	-0.000	0.000	1.200	0.17
24	24.52	956.60	4.24	0.000	0.000	-0.000	0.000	1.200	0.17
25	25.55	958.50	4.45	0.000	0.000	-0.000	0.000	1.200	0.17
26	26.57	960.50	4.66	0.000	0.000	-0.000	0.000	1.200	0.17
27	27.59	959.90	4.60	0.000	0.000	-0.000	0.000	1.200	0.17
28	28.61	960.70	4.69	0.000	0.000	-0.000	0.000	1.200	0.17
29	29.63	960.10	4.62	0.000	0.000	-0.000	0.000	1.200	0.17
30	30.66	960.00	4.61	0.000	0.000	-0.000	0.000	1.200	0.17
31	31.68	954.00	3.96	0.000	0.000	-0.000	0.000	1.200	0.17
32	32.70	937.00	2.10	0.000	0.000	-0.000	0.000	1.200	0.17

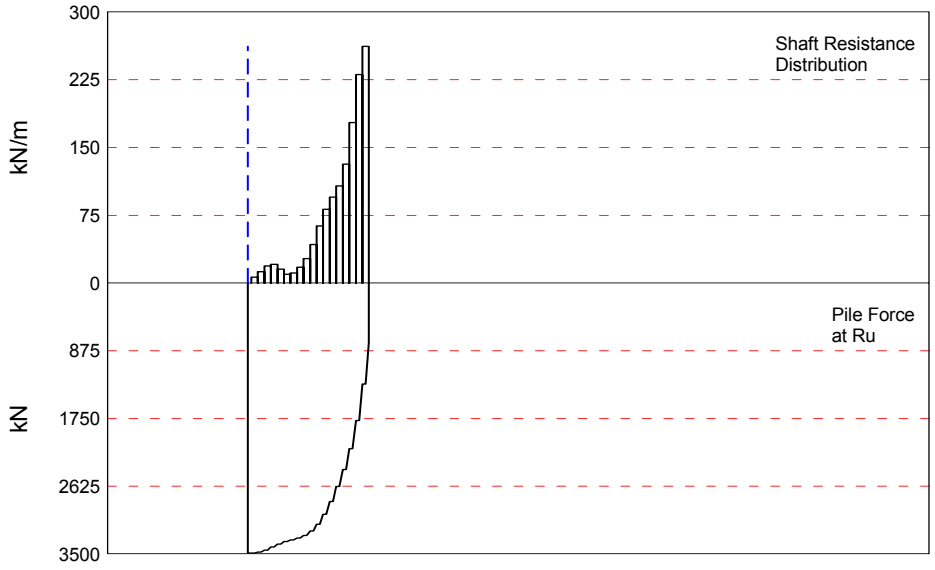
Pile Damping 2.0 %, Time Incr 0.255 ms, Wave Speed 4000.0 m/s, 2L/c 16.4 ms







Ru = 3488.7 kN
Rs = 2715.7 kN
Rb = 773.0 kN
Dy = 78.2 mm
Dx = 95.2 mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Zatelliitin koepaalutus; Pile: ZPT4 Test: 31-Mar-2015 14:45:
Vapaapudotusjarkale 9t; Blow: 37 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 3488.7; along Shaft 2715.7; at Toe 773.0 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				3488.7				
1	3.1	3.1	13.6	3475.1	13.6	4.45	4.37	0.344
2	5.1	5.1	25.4	3449.7	39.0	12.46	12.25	0.344
3	7.1	7.1	38.9	3410.8	77.9	19.09	18.76	0.344
4	9.2	9.2	42.1	3368.7	120.0	20.66	20.30	0.344
5	11.2	11.2	31.5	3337.2	151.5	15.46	15.19	0.344
6	13.2	13.2	20.0	3317.2	171.5	9.81	9.64	0.344
7	15.3	15.3	22.7	3294.5	194.2	11.14	10.95	0.344
8	17.3	17.3	36.1	3258.4	230.3	17.71	17.41	0.344
9	19.4	19.4	55.3	3203.1	285.6	27.14	26.67	0.344
10	21.4	21.4	87.3	3115.8	372.9	42.84	42.10	0.344
11	23.4	23.4	129.2	2986.6	502.1	63.40	62.31	0.344
12	25.5	25.5	166.4	2820.2	668.5	81.66	80.25	0.344
13	27.5	27.5	193.8	2626.4	862.3	95.10	93.46	0.344
14	29.5	29.5	219.1	2407.3	1081.4	107.52	105.66	0.344
15	31.6	31.6	268.0	2139.3	1349.4	131.51	129.24	0.344
16	33.6	33.6	362.2	1777.1	1711.6	177.74	174.67	0.344
17	35.7	35.7	470.1	1307.0	2181.7	230.69	226.70	0.344
18	37.7	37.7	534.0	773.0	2715.7	262.04	257.52	0.344
Avg. Shaft			150.9			72.03	70.79	0.344
Toe			773.0				9381.81	0.081

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	4.226	18.902
Case Damping Factor		2.311	0.155
Unloading Quake	(% of loading quake)	30	92
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	13	
Resistance Gap (included in Toe Quake)	(mm)		7.440
Soil Support Dashpot		4.500	0.000
Soil Support Weight	(kN)	10.37	0.00

CAPWAP match quality = 1.59 (Wave Up Match) ; RSA = 0
Observed: final set = 17.000 mm; blow count = 59 b/m
Computed: final set = 11.551 mm; blow count = 87 b/m

max. Top Comp. Stress = 395.1 MPa (T= 35.8 ms, max= 1.001 x Top)
max. Comp. Stress = 395.3 MPa (Z= 3.1 m, T= 36.2 ms)
max. Tens. Stress = -21.84 MPa (Z= 21.4 m, T= 71.0 ms)
max. Energy (EMX) = 162.24 kJ; max. Measured Top Displ. (DMX)=62.73 mm

Zatelliitin koepaalutus; Pile: ZPT4 Test: 31-Mar-2015 14:45:
Vapaapudotusjarkale 9t; Blow: 37 CAPWAP(R) 2006-2
Inspecta OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3896.5	-6.5	395.1	-0.66	162.24	7.9	60.772
2	2.0	3895.0	-9.2	395.0	-0.94	160.47	7.8	59.448
4	4.1	3864.8	-10.8	391.9	-1.10	154.87	7.6	56.762
6	6.1	3810.1	-39.4	386.4	-3.99	147.71	7.5	54.037
8	8.2	3688.4	-59.5	374.0	-6.03	138.93	7.3	51.276
10	10.2	3602.2	-79.2	365.3	-8.04	129.98	7.2	48.507
12	12.2	3543.0	-104.9	359.3	-10.64	122.46	7.1	45.700
14	14.3	3530.1	-135.1	358.0	-13.70	116.31	7.0	42.865
16	16.3	3523.7	-165.1	357.3	-16.74	110.01	6.7	40.011
18	18.3	3506.1	-186.5	355.5	-18.91	102.77	6.4	37.149
20	20.4	3451.8	-199.5	350.0	-20.23	94.61	6.0	34.328
22	22.4	3355.0	-189.5	340.2	-19.22	85.89	5.5	31.885
24	24.5	3214.3	-160.1	325.9	-16.24	75.83	5.0	29.528
26	26.5	3010.6	-106.4	305.3	-10.79	65.33	4.4	27.268
28	28.5	2803.0	-46.4	284.2	-4.70	55.30	3.8	25.159
30	30.6	2557.6	-1.0	259.4	-0.10	46.05	3.2	23.273
32	32.6	2266.7	-0.7	229.9	-0.08	37.16	2.9	21.720
33	33.6	2266.7	-0.8	229.9	-0.08	36.67	2.7	21.027
34	34.6	1806.6	-0.6	183.2	-0.06	27.63	2.5	20.474
35	35.7	1825.6	-0.6	185.1	-0.06	27.34	2.4	19.936
36	36.7	1271.2	-0.4	128.9	-0.04	17.46	2.3	19.473
37	37.7	1283.5	-0.4	130.2	-0.04	5.96	2.2	19.029
Absolute	3.1			395.3			(T =	36.2 ms)
	21.4				-21.84		(T =	71.0 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3178.2	3122.5	3066.8	3011.1	2955.4	2899.7	2844.0	2788.3	2732.6	2676.9
RX	4618.3	4429.9	4241.4	4053.0	3864.6	3676.1	3487.7	3299.3	3110.8	2939.9
RU	3178.2	3122.5	3066.8	3011.1	2955.4	2899.7	2844.0	2788.3	2732.6	2676.9

RAU = 2665.7 (kN); RA2 = 2971.5 (kN)

Current CAPWAP Ru = 3488.7 (kN); Corresponding J(RP)= 0.00; J(RX) = 0.60

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
7.97	22.28	1865.8	1869.5	3861.5	62.734	17.001	17.000	166.0	4163.4

Zatelliitin koepaalutus; Pile: ZPT4 Test: 31-Mar-2015 14:45:
Vapaapudotusjarkale 9t; Blow: 37 CAPWAP(R) 2006-2
Inspecta OP: TRe

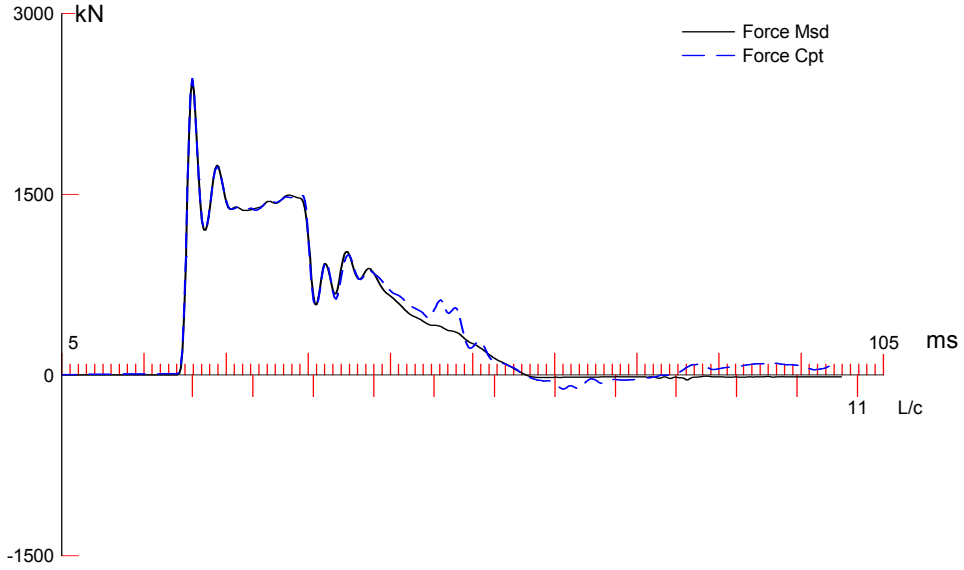
PILE PROFILE AND PILE MODEL

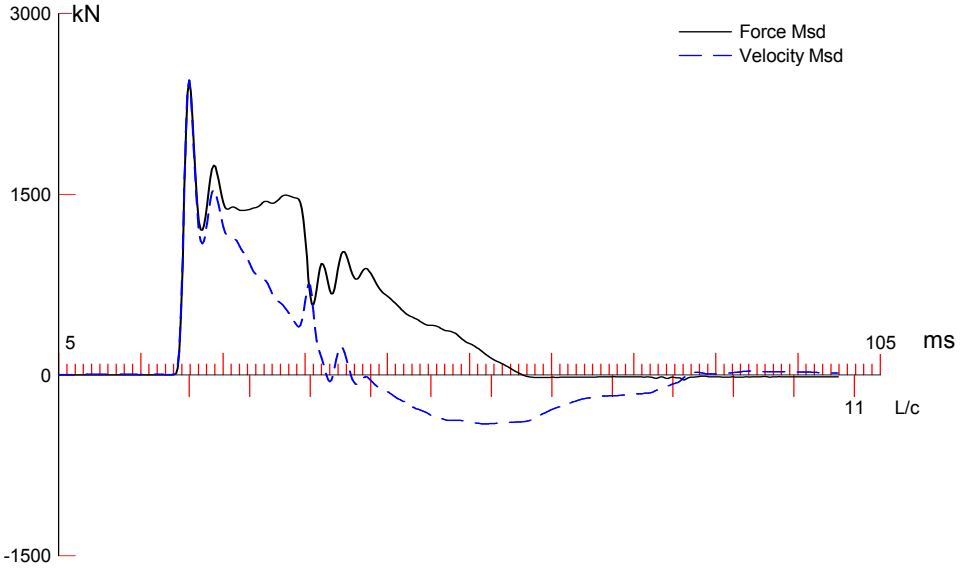
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
37.70	98.61	210000.0	78.500	1.018

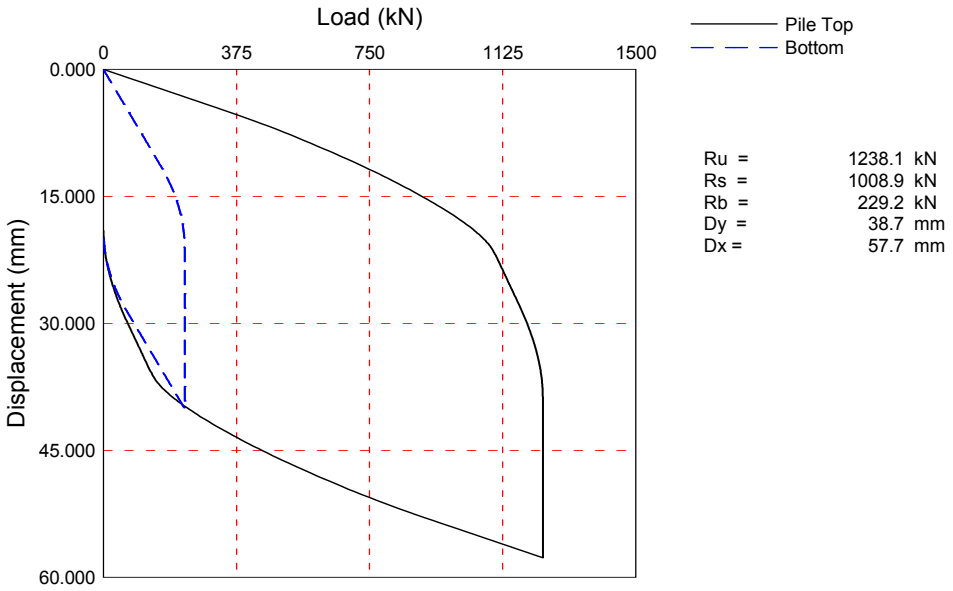
Toe Area 0.082 m^2

Top Segment Length 1.02 m, Top Impedance 404.32 kN/m/s

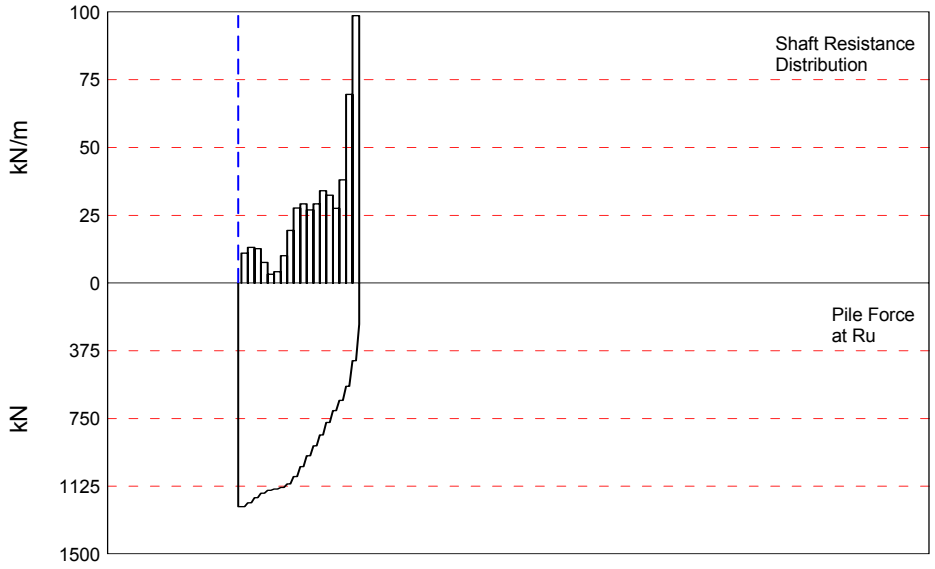
Pile Damping 1.0 %, Time Incr 0.199 ms, Wave Speed 5121.9 m/s, 2L/c 14.7 ms







Ru = 1238.1 kN
Rs = 1008.9 kN
Rb = 229.2 kN
Dy = 38.7 mm
Dx = 57.7 mm



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Koepaalutus Zatelliitti; Pile: ZPT4 24h — Test: 03-Mar-2015 12:48:
Junttan HHK 5A; Blow: 14 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1238.1; along Shaft 1008.9; at Toe 229.2 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				1238.1				
1	3.1	2.4	22.6	1215.5	22.6	9.59	9.42	0.324
2	5.1	4.4	26.9	1188.6	49.5	13.20	12.97	0.324
3	7.1	6.4	25.8	1162.8	75.3	12.66	12.44	0.324
4	9.2	8.5	15.5	1147.3	90.8	7.61	7.47	0.324
5	11.2	10.5	6.6	1140.7	97.4	3.24	3.18	0.324
6	13.2	12.5	8.5	1132.2	105.9	4.17	4.10	0.324
7	15.3	14.6	20.5	1111.7	126.4	10.06	9.89	0.324
8	17.3	16.6	39.5	1072.2	165.9	19.38	19.05	0.324
9	19.4	18.7	56.4	1015.8	222.3	27.68	27.20	0.324
10	21.4	20.7	59.6	956.2	281.9	29.25	28.74	0.324
11	23.4	22.7	55.0	901.2	336.9	26.99	26.52	0.324
12	25.5	24.8	59.6	841.6	396.5	29.25	28.74	0.324
13	27.5	26.8	69.5	772.1	466.0	34.10	33.52	0.324
14	29.5	28.8	66.1	706.0	532.1	32.44	31.88	0.324
15	31.6	30.9	56.3	649.7	588.4	27.63	27.15	0.324
16	33.6	32.9	77.7	572.0	666.1	38.13	37.47	0.324
17	35.7	35.0	141.8	430.2	807.9	69.58	68.38	0.324
18	37.7	37.0	201.0	229.2	1008.9	98.63	96.93	0.324
Avg. Shaft			56.1			27.27	26.80	0.324
Toe			229.2				2781.65	0.126

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	5.183	16.187
Case Damping Factor		0.808	0.071
Unloading Quake	(% of loading quake)	149	156
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Resistance Gap (included in Toe Quake)	(mm)		8.959
Soil Plug Weight	(kN)		0.08
Soil Support Dashpot		0.800	10.000
Soil Support Weight	(kN)	10.37	10.37

CAPWAP match quality = 1.61 (Force Match) ; RSA = 0
Observed: final set = 19.000 mm; blow count = 53 b/m
Computed: final set = 18.294 mm; blow count = 55 b/m

max. Top Comp. Stress = 249.4 MPa (T= 21.1 ms, max= 1.015 x Top)
max. Comp. Stress = 253.1 MPa (Z= 3.1 m, T= 21.7 ms)
max. Tens. Stress = -13.45 MPa (Z= 5.1 m, T= 67.2 ms)
max. Energy (EMX) = 62.70 kJ; max. Measured Top Displ. (DMX)=42.24 mm

Koepaalutus Zatelliitti; Pile: ZPT4 24h — Test: 03-Mar-2015 12:48:
Junttan HHK 5A; Blow: 14 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2459.8	-116.4	249.4	-11.81	62.70	6.0	41.795
2	2.0	2480.1	-114.4	251.5	-11.60	62.82	6.0	41.361
4	4.1	2452.8	-127.6	248.7	-12.94	60.75	5.9	40.500
6	6.1	2414.5	-126.6	244.8	-12.84	58.44	5.8	39.652
8	8.2	2370.7	-113.1	240.4	-11.47	56.28	5.8	38.821
10	10.2	2341.9	-116.9	237.5	-11.85	54.88	5.7	38.023
12	12.2	2334.6	-127.1	236.7	-12.89	54.14	5.7	37.275
14	14.3	2333.5	-129.5	236.6	-13.13	53.29	5.7	36.524
16	16.3	2323.0	-118.7	235.6	-12.04	51.73	5.5	35.795
18	18.3	2287.4	-107.2	232.0	-10.87	49.13	5.4	35.099
20	20.4	2222.5	-104.8	225.4	-10.63	45.71	5.2	34.436
22	22.4	2151.6	-93.6	218.2	-9.49	42.25	5.1	33.835
24	24.5	2093.5	-74.5	212.3	-7.55	39.13	4.9	33.258
26	26.5	2035.3	-61.5	206.4	-6.24	35.83	4.8	32.624
28	28.5	1960.5	-51.2	198.8	-5.19	32.08	4.6	32.031
30	30.6	1889.3	-45.5	191.6	-4.62	28.69	4.5	31.649
32	32.6	1849.7	-46.0	187.6	-4.67	25.83	4.3	31.282
33	33.6	1892.9	-49.7	192.0	-5.04	25.78	4.2	31.069
34	34.6	1749.9	-43.8	177.4	-4.44	22.06	4.2	30.868
35	35.7	1595.9	-44.8	161.8	-4.55	22.03	5.0	30.687
36	36.7	1006.5	-30.2	102.1	-3.06	15.54	5.8	30.548
37	37.7	686.6	-32.9	69.6	-3.34	6.28	6.2	30.382
Absolute	3.1			253.1			(T =	21.7 ms)
	5.1				-13.45		(T =	67.2 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	2416.7	2165.6	1914.5	1663.4	1412.3	1161.2	910.1	659.0	407.9	156.8
RX	2416.7	2165.6	1914.5	1663.4	1448.9	1317.8	1206.0	1122.9	1047.4	973.1
RU	2416.7	2165.6	1914.5	1663.4	1412.3	1161.2	910.1	659.0	407.9	156.8

RAU = 729.9 (kN); RA2 = 1481.0 (kN)

Current CAPWAP Ru = 1238.1 (kN); Corresponding J(RP)= 0.47; J(RX) = 0.57

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
6.10	21.09	2465.5	2462.2	2462.2	42.236	18.999	19.000	63.3	2066.0

Koepaalutus Zatelliitti; Pile: ZPT4 24h — Test: 03-Mar-2015 12:48:
Junttan HHK 5A; Blow: 14 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

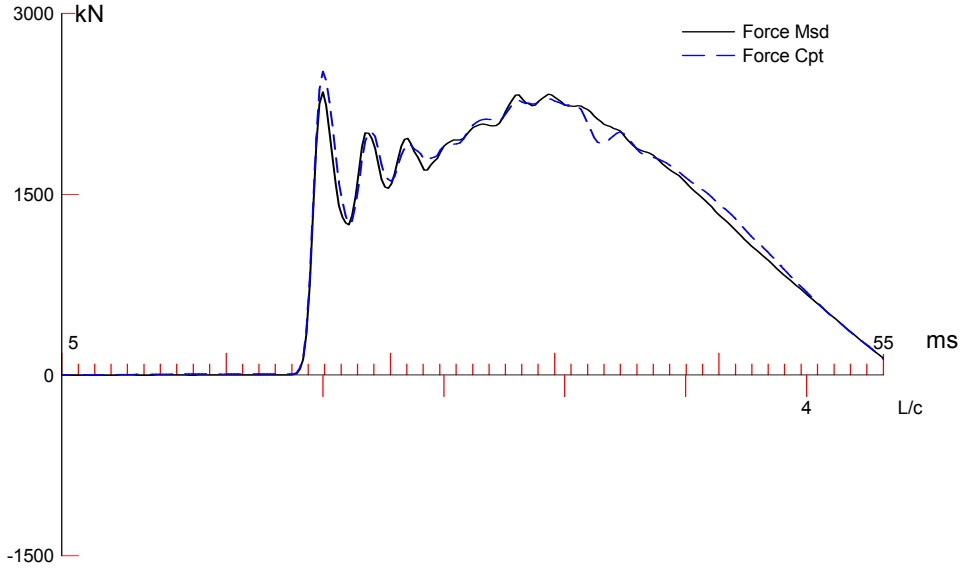
PILE PROFILE AND PILE MODEL

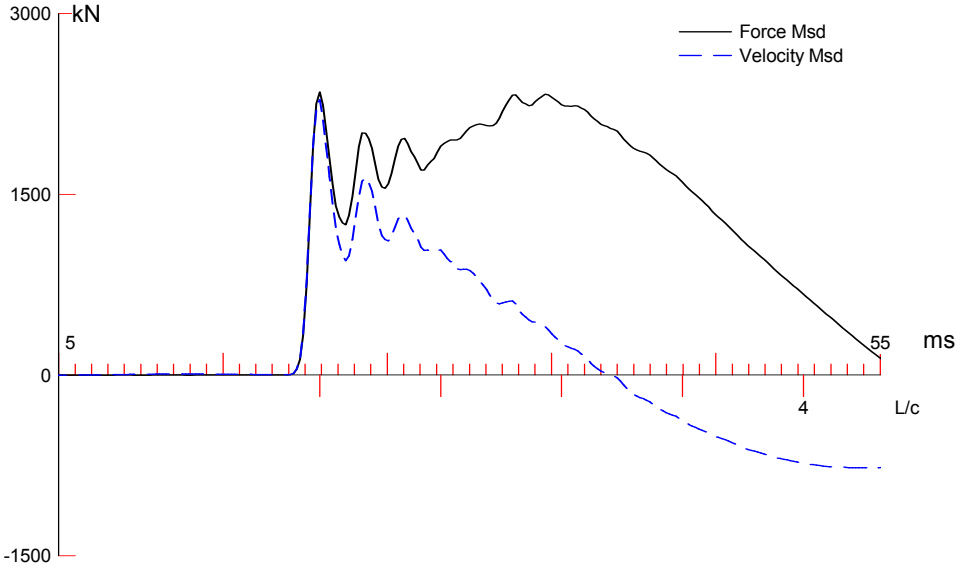
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
37.70	98.61	210000.0	78.500	1.018

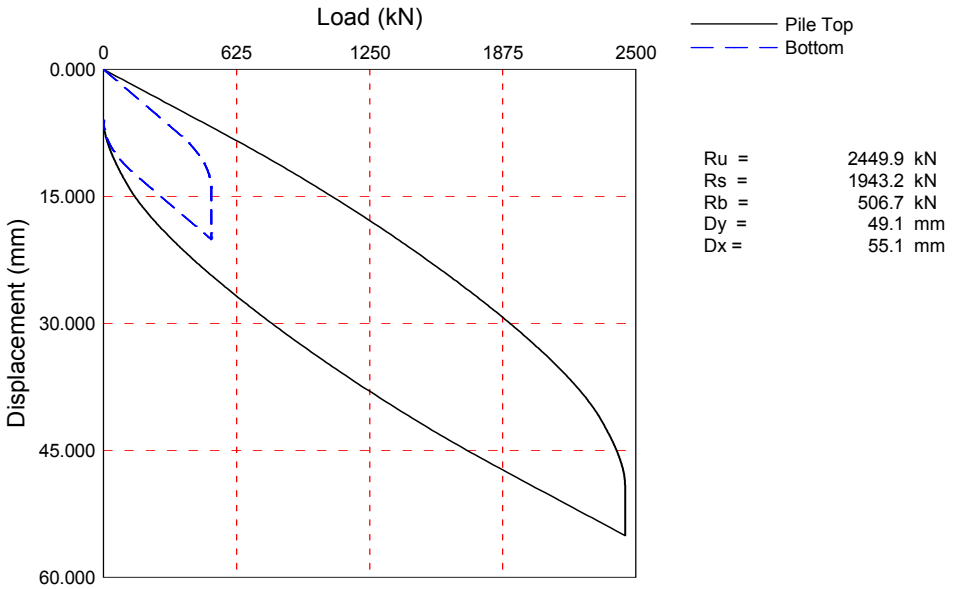
Toe Area 0.082 m^2

Top Segment Length 1.02 m, Top Impedance 404.32 kN/m/s

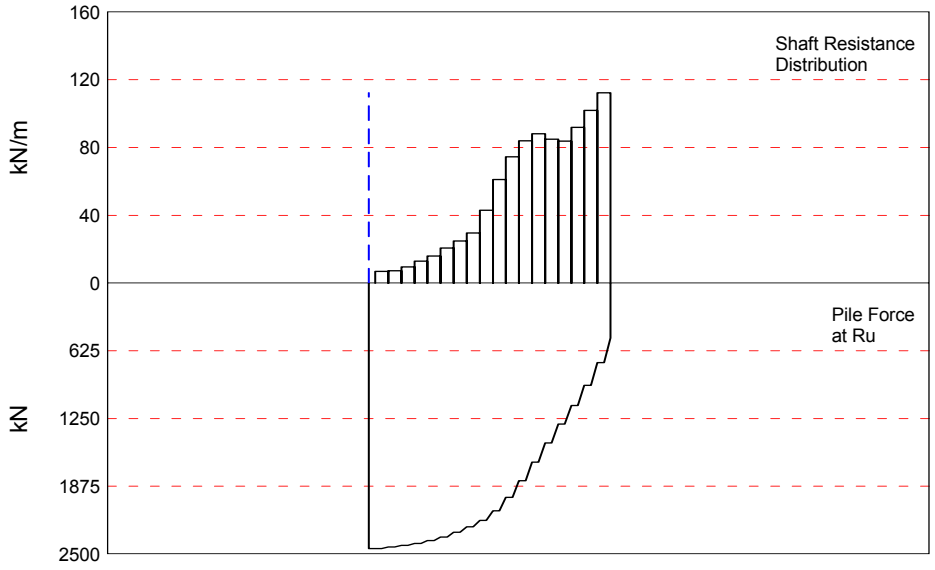
Pile Damping 1.0 %, Time Incr 0.199 ms, Wave Speed 5121.9 m/s, 2L/c 14.7 ms







Ru = 2449.9 kN
Rs = 1943.2 kN
Rb = 506.7 kN
Dy = 49.1 mm
Dx = 55.1 mm



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Zatelliitin koepaalutus 14vrk; Pile: ZPT4 14 vrk — Test: 18-Mar-2015 10:37:
Junttan HHK 7A; Blow: 14 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2449.9; along Shaft 1943.2; at Toe 506.7 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m	Quake mm
				2449.9					
1	3.1	3.1	14.3	2435.6	14.3	4.68	4.60	0.628	7.500
2	5.1	5.1	14.7	2420.9	29.0	7.21	7.09	0.628	7.501
3	7.1	7.1	19.4	2401.5	48.4	9.52	9.36	0.628	7.501
4	9.2	9.2	26.3	2375.2	74.7	12.91	12.68	0.628	7.501
5	11.2	11.2	32.6	2342.6	107.3	16.00	15.72	0.628	7.501
6	13.2	13.2	42.3	2300.3	149.6	20.76	20.40	0.628	7.501
7	15.3	15.3	50.6	2249.7	200.2	24.83	24.40	0.628	7.501
8	17.3	17.3	60.2	2189.5	260.4	29.54	29.03	0.628	7.501
9	19.4	19.4	87.7	2101.8	348.1	43.04	42.29	0.628	7.501
10	21.4	21.4	124.7	1977.1	472.8	61.19	60.14	0.628	7.501
11	23.4	23.4	151.9	1825.2	624.7	74.54	73.25	0.628	7.501
12	25.5	25.5	171.2	1654.0	795.9	84.01	82.56	0.628	7.501
13	27.5	27.5	179.4	1474.6	975.3	88.03	86.52	0.628	7.501
14	29.5	29.5	173.1	1301.5	1148.4	84.94	83.48	0.628	7.501
15	31.6	31.6	171.0	1130.5	1319.4	83.91	82.46	0.628	7.501
16	33.6	33.6	187.2	943.3	1506.6	91.86	90.28	0.628	7.501
17	35.7	35.7	207.6	735.7	1714.2	101.87	100.11	0.628	7.039
18	37.7	37.7	229.0	506.7	1943.2	112.37	110.43	0.628	5.845
Avg. Shaft			108.0			51.54	50.65	0.628	7.256
Toe			506.7				6149.49	0.093	10.862

Soil Model Parameters/Extensions		Shaft	Toe
Case Damping Factor		3.020	0.116
Unloading Quake	(% of loading quake)	34	58
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Resistance Gap (included in Toe Quake)	(mm)		0.416
Soil Plug Weight	(kN)		0.35
Soil Support Dashpot		2.100	0.000
Soil Support Weight	(kN)	10.37	0.00

CAPWAP match quality = 1.92 (Force Match) ; RSA = 0
Observed: final set = 6.000 mm; blow count = 167 b/m
Computed: final set = 4.977 mm; blow count = 201 b/m

max. Top Comp. Stress = 255.4 MPa (T= 21.1 ms, max= 1.038 x Top)
max. Comp. Stress = 265.2 MPa (Z= 3.1 m, T= 21.7 ms)
max. Tens. Stress = -21.93 MPa (Z= 17.3 m, T= 63.1 ms)
max. Energy (EMX) = 75.62 kJ; max. Measured Top Displ. (DMX)=40.15 mm

Zatelliitin koepaalutus 14vrk; Pile: ZPT4 14 vrk — Test: 18-Mar-2015 10:37:
Junttan HHK 7A; Blow: 14 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2518.7	-181.4	255.4	-18.40	75.62	5.5	39.176
2	2.0	2602.9	-187.9	263.9	-19.05	75.02	5.4	38.201
4	4.1	2569.4	-188.0	260.5	-19.07	71.50	5.4	36.196
6	6.1	2522.6	-185.3	255.8	-18.79	67.99	5.2	34.167
8	8.2	2510.0	-179.6	254.5	-18.21	64.28	5.2	32.167
10	10.2	2458.5	-179.6	249.3	-18.21	60.15	5.0	30.142
12	12.2	2399.7	-193.7	243.3	-19.64	55.84	4.9	28.124
14	14.3	2344.8	-202.5	237.8	-20.53	51.28	4.7	26.147
16	16.3	2256.8	-205.1	228.8	-20.79	46.65	4.5	24.198
18	18.3	2182.3	-202.7	221.3	-20.56	42.05	4.3	22.303
20	20.4	2081.9	-186.6	211.1	-18.92	36.95	4.0	20.488
22	22.4	1922.6	-152.3	195.0	-15.44	31.48	3.6	18.787
24	24.5	1758.7	-106.7	178.3	-10.82	26.24	3.2	17.256
26	26.5	1590.2	-82.1	161.3	-8.32	21.48	2.9	15.890
28	28.5	1403.2	-64.0	142.3	-6.49	17.32	2.6	14.665
30	30.6	1248.0	-47.6	126.6	-4.82	13.89	2.3	13.573
32	32.6	1116.3	-36.8	113.2	-3.73	11.00	2.1	12.681
33	33.6	1164.0	-38.9	118.0	-3.94	10.83	1.9	12.290
34	34.6	1005.1	-37.7	101.9	-3.82	8.44	1.8	11.947
35	35.7	1027.4	-47.3	104.2	-4.80	8.32	1.7	11.610
36	36.7	719.9	-38.9	73.0	-3.95	5.97	2.2	11.317
37	37.7	713.8	-41.2	72.4	-4.17	3.20	2.4	11.024
Absolute	3.1			265.2			(T =	21.7 ms)
	17.3				-21.93		(T =	63.1 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3334.5	3198.9	3063.3	2927.7	2792.1	2656.5	2520.9	2385.3	2249.7	2114.1
RX	3334.5	3198.9	3063.3	2927.7	2792.1	2656.5	2520.9	2385.7	2250.7	2130.2
RU	3334.5	3198.9	3063.3	2927.7	2792.1	2656.5	2520.9	2385.3	2249.7	2114.1

RAU = 208.3 (kN); RA2 = 2212.7 (kN)

Current CAPWAP Ru = 2449.9 (kN); Corresponding J(RP)= 0.65; J(RX) = 0.65

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
5.75	21.09	2326.5	2364.0	2374.5	40.149	5.998	6.000	75.5	3272.7

PILE PROFILE AND PILE MODEL

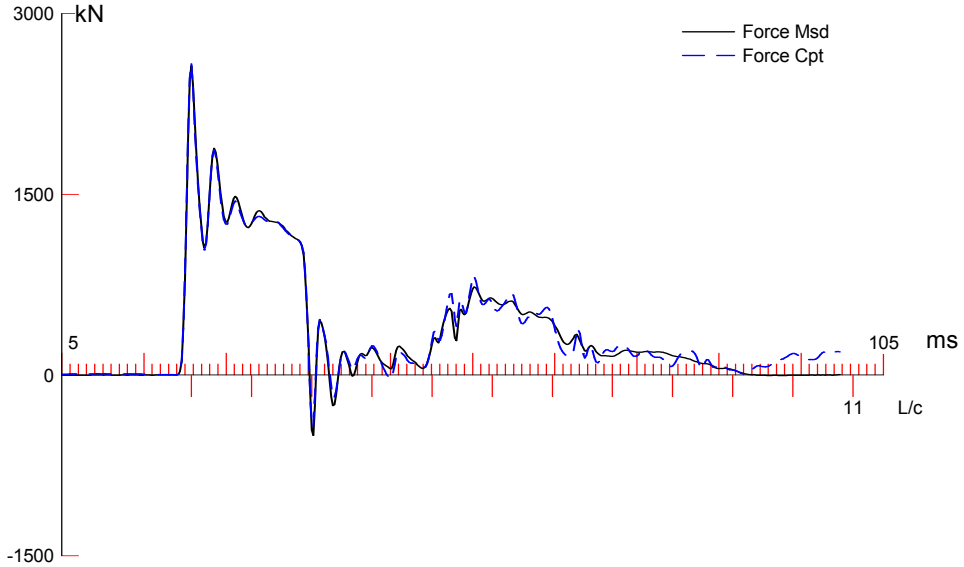
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
37.70	98.61	210000.0	78.500	1.018

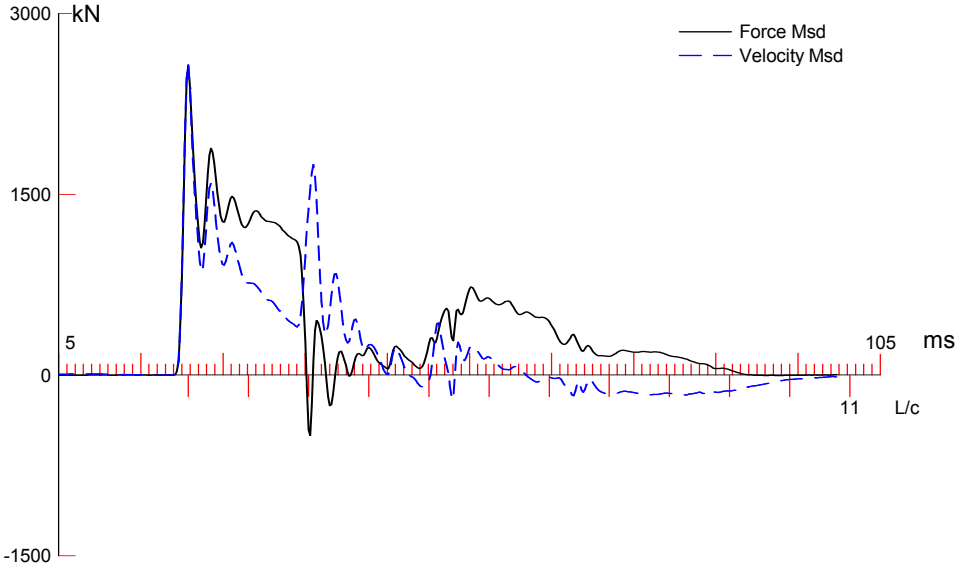
Zatelliitin koepaalutus 14vrk; Pile: ZPT4 14 vrk Test: 18-Mar-2015 10:37:
Junttan HHK 7A; Blow: 14 CAPWAP(R) 2006-2
Inspecta OP: TRe

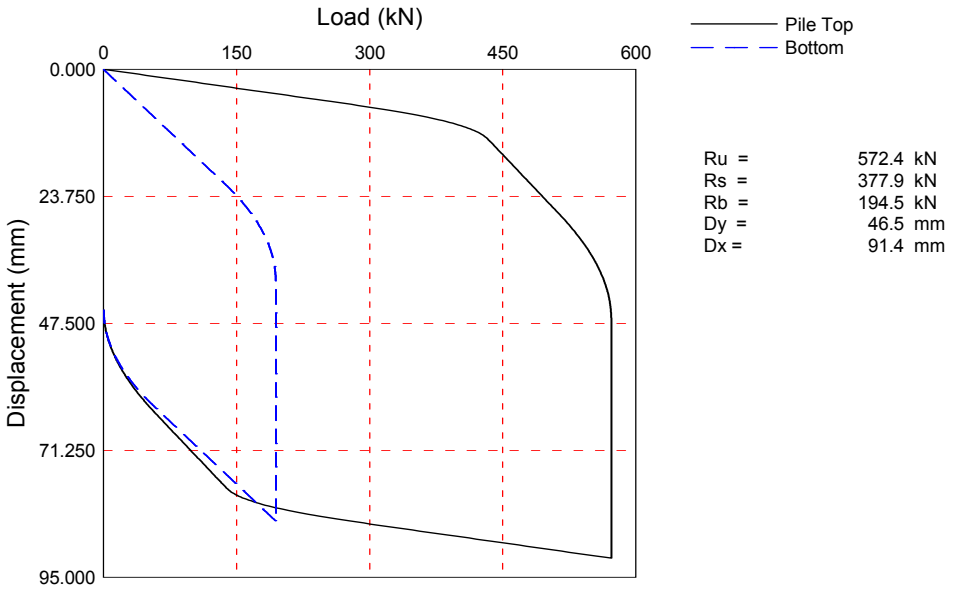
Toe Area 0.082 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.02	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.04	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.14
37	37.70	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.14

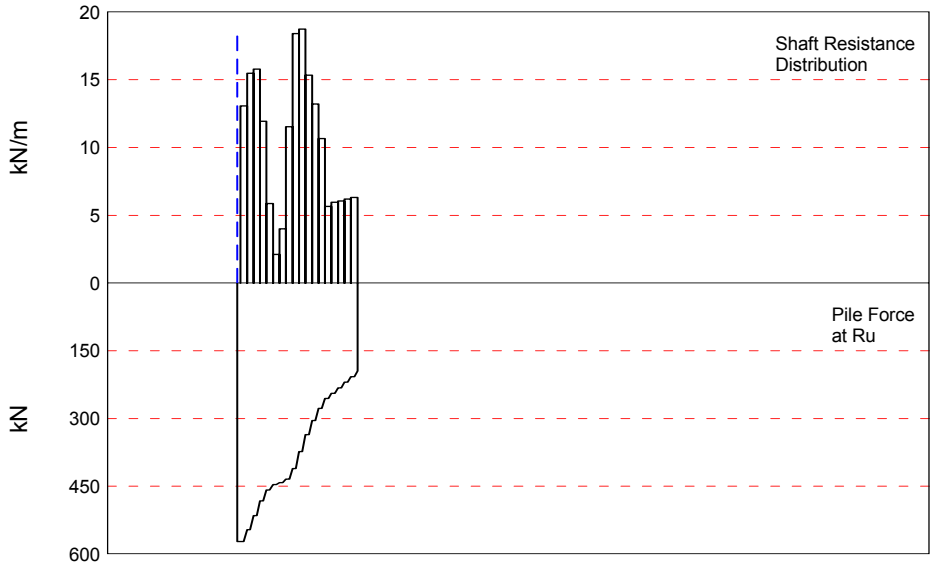
Pile Damping 1.0 %, Time Incr 0.199 ms, Wave Speed 5121.9 m/s, 2L/c 14.7 ms







Ru = 572.4 kN
Rs = 377.9 kN
Rb = 194.5 kN
Dy = 46.5 mm
Dx = 91.4 mm



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Koepaalutus Zatelliitti; Pile: ZPT4 0h — Test: 02-Mar-2015 12:09:
Junttan HHK 5A; Blow: 816 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 572.4; along Shaft 377.9; at Toe 194.5 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				572.4				
1	3.0	2.5	26.5	545.9	26.5	10.43	10.25	0.531
2	5.1	4.6	31.4	514.5	57.9	15.49	15.22	0.531
3	7.1	6.6	32.0	482.5	89.9	15.79	15.51	0.531
4	9.1	8.6	24.2	458.3	114.1	11.94	11.73	0.531
5	11.1	10.6	11.9	446.4	126.0	5.87	5.77	0.531
6	13.2	12.7	4.3	442.1	130.3	2.12	2.08	0.531
7	15.2	14.7	8.1	434.0	138.4	4.00	3.93	0.531
8	17.2	16.7	23.4	410.6	161.8	11.54	11.34	0.531
9	19.3	18.8	37.3	373.3	199.1	18.40	18.08	0.531
10	21.3	20.8	38.0	335.3	237.1	18.75	18.42	0.531
11	23.3	22.8	31.1	304.2	268.2	15.34	15.08	0.531
12	25.3	24.8	26.8	277.4	295.0	13.22	12.99	0.531
13	27.4	26.9	21.6	255.8	316.6	10.66	10.47	0.531
14	29.4	28.9	11.5	244.3	328.1	5.67	5.58	0.531
15	31.4	30.9	12.1	232.2	340.2	5.97	5.87	0.531
16	33.4	32.9	12.3	219.9	352.5	6.07	5.96	0.531
17	35.5	35.0	12.6	207.3	365.1	6.22	6.11	0.531
18	37.5	37.0	12.8	194.5	377.9	6.31	6.21	0.531
Avg. Shaft			21.0			10.21	10.04	0.531
Toe			194.5				2360.52	0.058

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	7.222	30.437
Case Damping Factor		0.496	0.028
Unloading Quake	(% of loading quake)	33	135
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Resistance Gap (included in Toe Quake)	(mm)		9.960
Soil Plug Weight	(kN)		0.21
Soil Support Dashpot		0.000	4.550
Soil Support Weight	(kN)	0.00	10.31

CAPWAP match quality = 1.41 (Force Match) ; RSA = 0
Observed: final set = 45.000 mm; blow count = 22 b/m
Computed: final set = 42.708 mm; blow count = 23 b/m

max. Top Comp. Stress = 262.2 MPa (T= 21.0 ms, max= 1.023 x Top)
max. Comp. Stress = 268.2 MPa (Z= 3.0 m, T= 21.6 ms)
max. Tens. Stress = -100.77 MPa (Z= 33.4 m, T= 29.3 ms)
max. Energy (EMX) = 55.98 kJ; max. Measured Top Displ. (DMX)=53.62 mm

Koepaalutus Zatelliitti; Pile: ZPT4 0h — Test: 02-Mar-2015 12:09:
Junttan HHK 5A; Blow: 816 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2585.4	-422.5	262.2	-42.84	55.98	6.4	53.374
2	2.0	2619.8	-308.8	265.7	-31.32	56.33	6.3	53.142
4	4.1	2573.1	-313.4	260.9	-31.78	53.04	6.1	52.860
6	6.1	2512.4	-358.6	254.8	-36.36	49.20	6.0	52.588
8	8.1	2441.5	-396.1	247.6	-40.16	45.26	5.9	52.220
10	10.1	2380.9	-395.7	241.4	-40.13	42.29	5.8	51.976
12	12.2	2348.9	-372.0	238.2	-37.72	40.81	5.8	51.835
14	14.2	2344.9	-372.2	237.8	-37.74	40.24	5.7	51.685
16	16.2	2347.2	-345.1	238.0	-34.99	39.19	5.7	51.448
18	18.2	2320.5	-417.5	235.3	-42.34	36.26	5.5	51.179
20	20.3	2256.8	-552.3	228.8	-56.00	31.61	5.4	50.912
22	22.3	2185.4	-564.3	221.6	-57.22	26.84	5.6	50.633
24	24.3	2129.5	-540.2	215.9	-54.78	22.86	6.0	50.431
26	26.4	2080.4	-759.8	211.0	-77.05	19.39	5.7	50.241
28	28.4	2035.1	-720.6	206.4	-73.07	16.55	6.2	50.072
30	30.4	2015.5	-384.4	204.4	-38.98	14.97	7.0	49.915
32	32.4	1994.4	-862.1	202.2	-87.42	13.28	6.3	49.729
33	33.4	2001.2	-993.7	202.9	-100.77	13.26	5.7	49.638
34	34.5	1930.4	-968.3	195.8	-98.19	11.59	6.1	49.566
35	35.5	1678.3	-708.3	170.2	-71.82	11.58	6.9	49.503
36	36.5	1125.3	-418.6	114.1	-42.45	9.79	8.1	49.437
37	37.5	349.6	-0.1	35.4	-0.01	7.74	8.9	49.354
Absolute	3.0			268.2			(T =	21.6 ms)
	33.4				-100.77		(T =	29.3 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	1828.5	1487.5	1146.5	805.5	464.5	123.5	0.0	0.0	0.0	0.0
RX	1828.5	1487.5	1146.5	805.5	638.6	561.3	518.1	505.6	496.8	495.7
RU	1828.5	1487.5	1146.5	805.5	464.5	123.5	0.0	0.0	0.0	0.0

RAU = 396.4 (kN); RA2 = 821.7 (kN)

Current CAPWAP Ru = 572.4 (kN); Corresponding J(RP)= 0.37; J(RX) = 0.49

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
6.49	20.97	2624.6	2613.9	2613.9	53.616	44.372	45.000	56.9	1153.5

Koepaalutus Zatelliitti; Pile: ZPT4 0h — Test: 02-Mar-2015 12:09:
Junttan HHK 5A; Blow: 816 — CAPWAP(R) 2006-2
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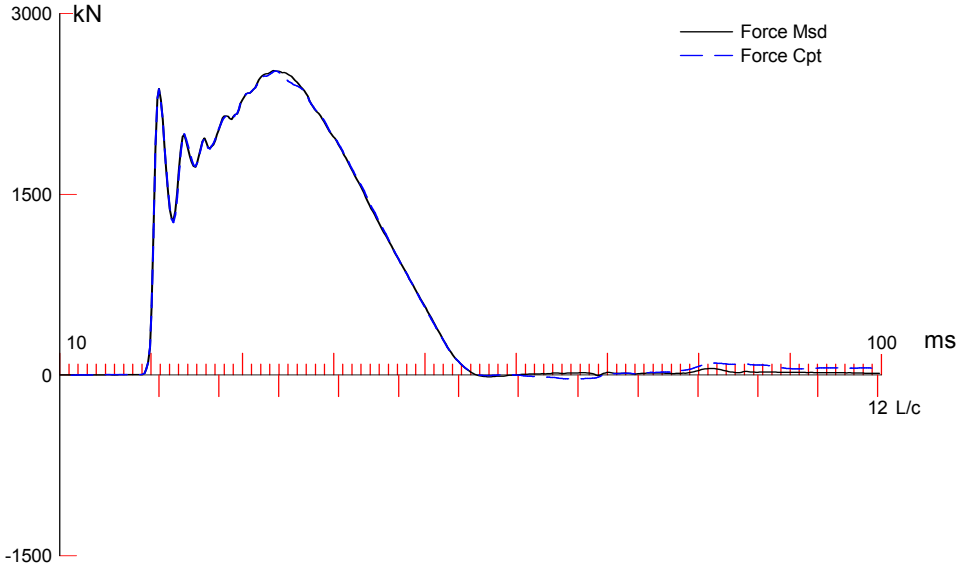
PILE PROFILE AND PILE MODEL

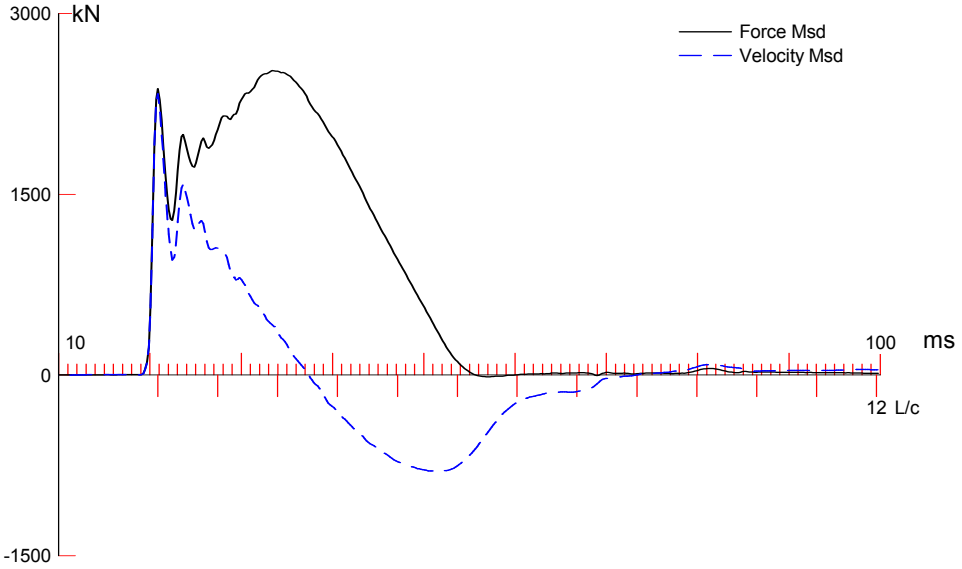
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
37.50	98.61	210000.0	78.500	1.018

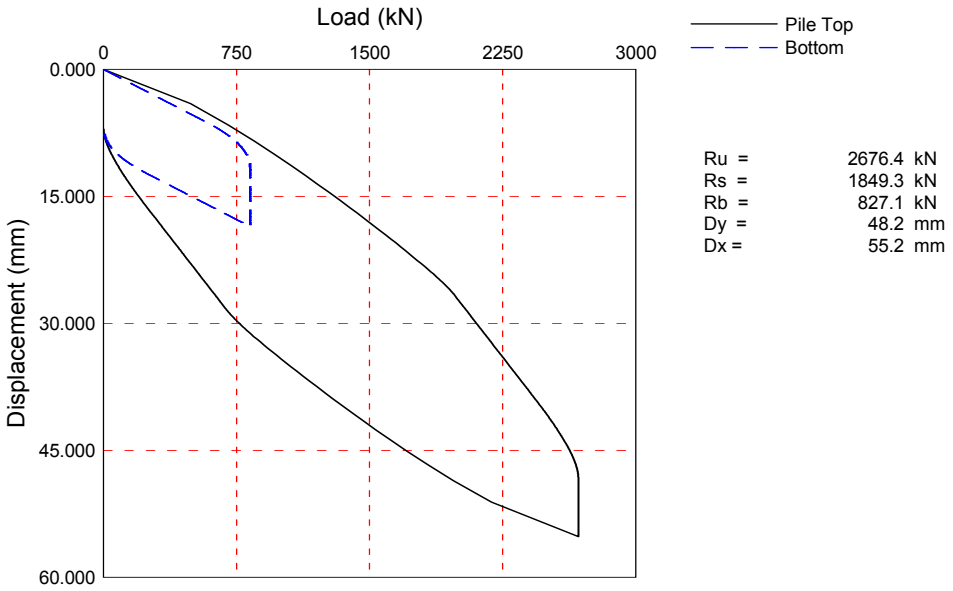
Toe Area 0.082 m^2

Top Segment Length 1.01 m, Top Impedance 404.32 kN/m/s

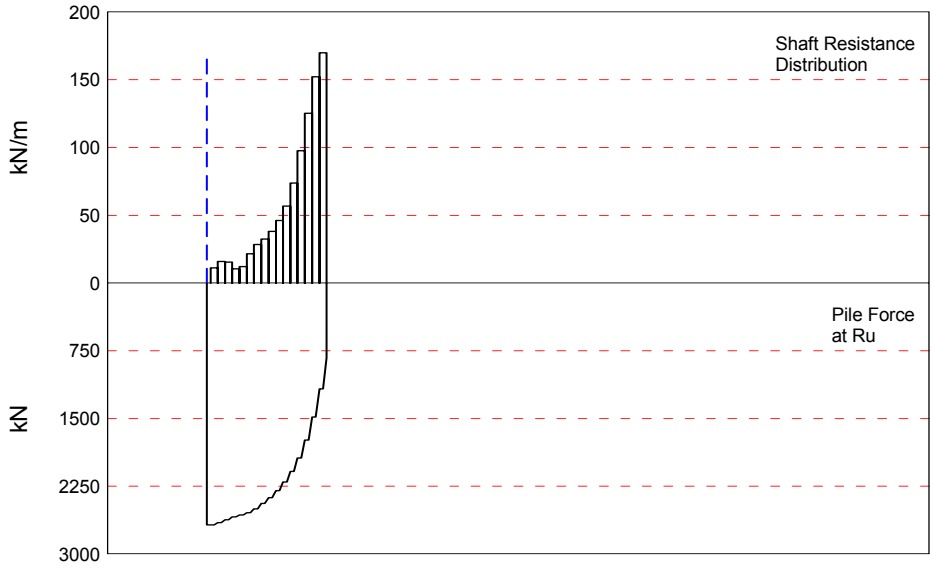
Pile Damping 1.0 %, Time Incr 0.198 ms, Wave Speed 5121.9 m/s, 2L/c 14.6 ms







Ru =	2676.4	kN
Rs =	1849.3	kN
Rb =	827.1	kN
Dy =	48.2	mm
Dx =	55.2	mm



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Zatelliitin koepaalutus 14vrk; Pile: ZPT5 14 vrk — Test: 18-Mar-2015 10:08:
Junttan HHK 7A; Blow: 10 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2676.4; along Shaft 1849.3; at Toe 827.1 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				2676.4				
1	3.1	3.1	22.8	2653.6	22.8	7.46	7.34	0.870
2	5.1	5.1	32.4	2621.2	55.2	15.91	15.64	0.870
3	7.1	7.1	31.6	2589.6	86.8	15.52	15.25	0.870
4	9.2	9.2	21.4	2568.2	108.2	10.51	10.33	0.870
5	11.2	11.2	25.0	2543.2	133.2	12.28	12.06	0.870
6	13.2	13.2	43.8	2499.4	177.0	21.51	21.14	0.870
7	15.3	15.3	58.1	2441.3	235.1	28.53	28.04	0.870
8	17.3	17.3	66.1	2375.2	301.2	32.46	31.90	0.870
9	19.3	19.3	77.9	2297.3	379.1	38.25	37.59	0.870
10	21.4	21.4	93.9	2203.4	473.0	46.11	45.32	0.870
11	23.4	23.4	115.8	2087.6	588.8	56.87	55.88	0.870
12	25.5	25.5	150.4	1937.2	739.2	73.86	72.58	0.870
13	27.5	27.5	198.9	1738.3	938.1	97.67	95.99	0.870
14	29.5	29.5	255.3	1483.0	1193.4	125.37	123.21	0.870
15	31.6	31.6	309.9	1173.1	1503.3	152.18	149.56	0.870
16	33.6	33.6	346.0	827.1	1849.3	169.91	166.98	0.870
Avg. Shaft			115.6			55.04	54.09	0.870
Toe			827.1				10037.97	0.019

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	1.004	8.897
Case Damping Factor		3.979	0.039
Unloading Quake	(% of loading quake)	30	51
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Resistance Gap (included in Toe Quake)	(mm)		0.390
Soil Plug Weight	(kN)		2.36
Soil Support Dashpot		3.155	0.000
Soil Support Weight	(kN)	10.36	0.00

CAPWAP match quality = 1.21 (Wave Up Match) ; RSA = 0
Observed: final set = 7.000 mm; blow count = 143 b/m
Computed: final set = 5.478 mm; blow count = 183 b/m

max. Top Comp. Stress = 258.2 MPa (T= 33.8 ms, max= 1.010 x Top)
max. Comp. Stress = 260.7 MPa (Z= 3.1 m, T= 33.2 ms)
max. Tens. Stress = -11.72 MPa (Z= 13.2 m, T= 58.8 ms)
max. Energy (EMX) = 74.99 kJ; max. Measured Top Displ. (DMX)=37.86 mm

Zatelliitin koepaalutus 14vrk; Pile: ZPT5 14 vrk — Test: 18-Mar-2015 10:08:
Junttan HHK 7A; Blow: 10 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2545.9	-37.1	258.2	-3.76	74.99	5.7	37.107
2	2.0	2551.6	-44.3	258.7	-4.50	73.70	5.6	35.979
4	4.1	2546.5	-60.7	258.2	-6.16	68.47	5.4	33.724
6	6.1	2493.9	-67.9	252.9	-6.88	62.57	5.2	31.488
8	8.1	2476.0	-76.6	251.1	-7.76	57.15	5.0	29.283
10	10.2	2467.7	-93.0	250.2	-9.43	52.93	4.9	27.098
12	12.2	2437.4	-103.0	247.2	-10.45	48.73	4.6	24.945
14	14.3	2369.3	-95.7	240.3	-9.70	43.72	4.3	22.839
16	16.3	2299.1	-78.7	233.1	-7.98	38.50	4.0	20.789
18	18.3	2209.5	-60.2	224.1	-6.10	33.58	3.6	18.818
20	20.4	2109.6	-38.4	213.9	-3.89	28.96	3.3	16.967
22	22.4	1992.9	-17.2	202.1	-1.75	24.66	2.8	15.261
24	24.4	1852.8	-12.9	187.9	-1.30	20.67	2.4	13.725
25	25.5	1858.7	-14.2	188.5	-1.44	20.15	2.2	13.013
26	26.5	1682.4	-7.1	170.6	-0.72	16.90	1.9	12.372
27	27.5	1687.1	-8.4	171.1	-0.85	16.54	1.7	11.773
28	28.5	1476.6	-2.2	149.7	-0.23	13.33	1.5	11.224
29	29.5	1481.9	-2.2	150.3	-0.23	13.05	1.3	10.706
30	30.5	1242.8	-1.6	126.0	-0.16	9.97	1.1	10.232
31	31.6	1249.2	-1.6	126.7	-0.16	9.76	0.9	9.775
32	32.6	1004.1	-0.9	101.8	-0.09	6.91	0.8	9.344
33	33.6	1010.3	-0.9	102.4	-0.09	3.62	0.9	8.922
Absolute	3.1			260.7			(T =	33.2 ms)
	13.2				-11.72		(T =	58.8 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3460.3	3330.0	3199.8	3069.5	2939.2	2808.9	2678.6	2548.4	2418.1	2287.8
RX	3460.3	3330.0	3199.8	3069.5	2939.5	2811.7	2684.0	2556.2	2428.5	2364.1
RU	3460.3	3330.0	3199.8	3069.5	2939.2	2808.9	2678.6	2548.4	2418.1	2287.8

RAU = 2259.3 (kN); RA2 = 2436.8 (kN)

Current CAPWAP Ru = 2676.4 (kN); Corresponding J(RP)= 0.60; J(RX) = 0.61

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
5.85	21.07	2364.7	2398.5	2529.7	37.860	6.998	7.000	75.8	3378.8

PILE PROFILE AND PILE MODEL

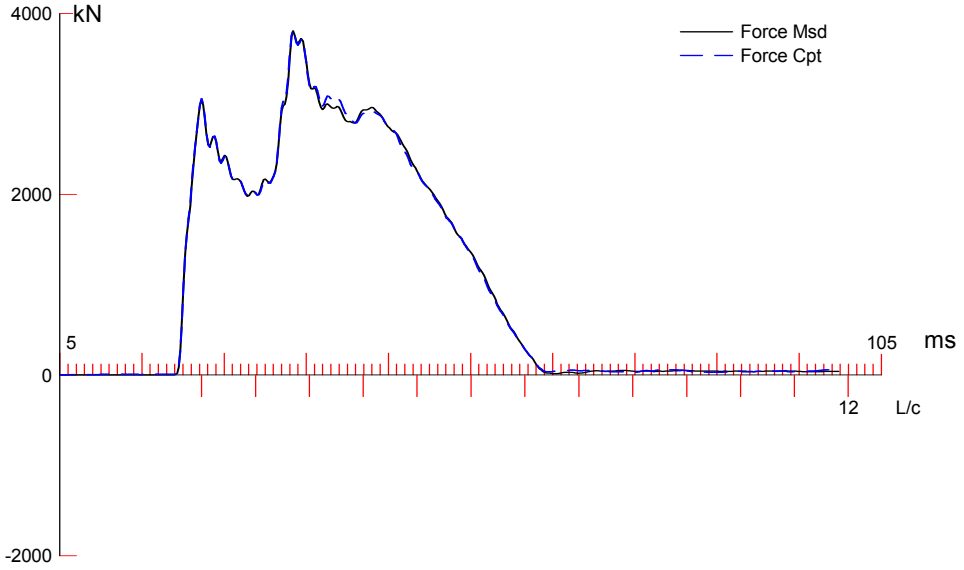
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
33.60	98.61	210000.0	78.500	1.018

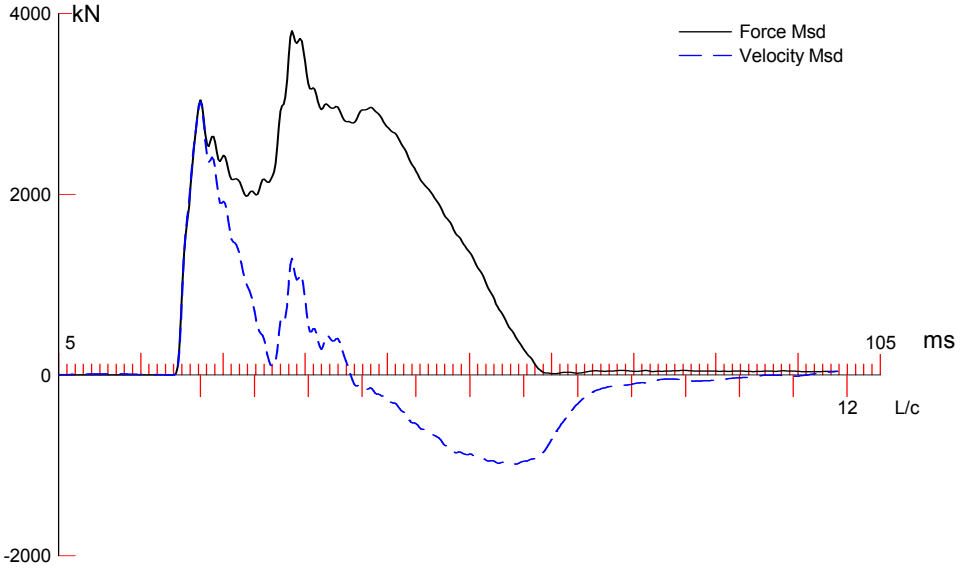
Zatelliitin koepaalutus 14vrk; Pile: ZPT5 14 vrk Test: 18-Mar-2015 10:08:
Junttan HHK 7A; Blow: 10 CAPWAP(R) 2006-2
Inspecta OP: TRe

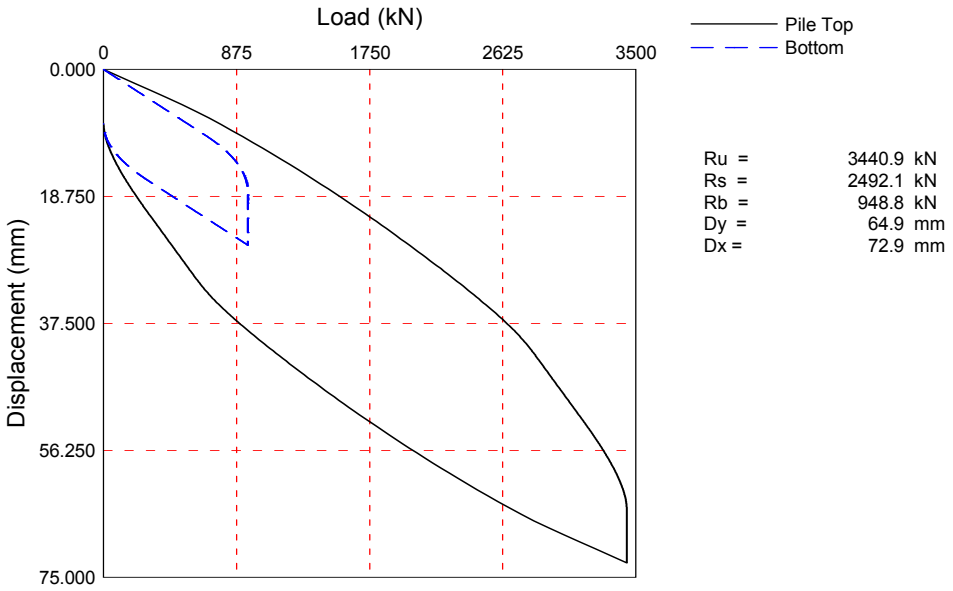
Toe Area 0.082 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.02	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.04	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02
3	3.05	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02
33	33.60	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02

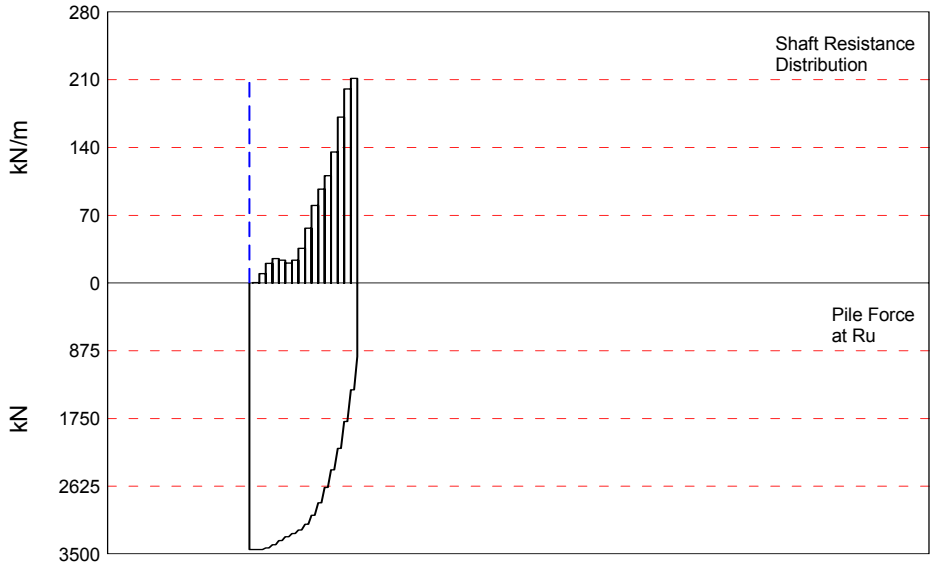
Pile Damping 1.0 %, Time Incr 0.199 ms, Wave Speed 5121.9 m/s, 2L/c 13.1 ms







Ru = 3440.9 kN
Rs = 2492.1 kN
Rb = 948.8 kN
Dy = 64.9 mm
Dx = 72.9 mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Zatelliitin koepaalutus; Pile: ZPT5 Test: 31-Mar-2015 14:16:
Vapaapudotusjarkale 9t; Blow: 8 CAPWAP(R) 2006-2
Inspecta OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 3440.9; along Shaft 2492.1; at Toe 948.8 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				3440.9				
1	3.1	3.1	0.9	3440.0	0.9	0.29	0.29	0.379
2	5.1	5.1	20.0	3420.0	20.9	9.82	9.65	0.379
3	7.1	7.1	41.7	3378.3	62.6	20.48	20.12	0.379
4	9.2	9.2	51.8	3326.5	114.4	25.44	25.00	0.379
5	11.2	11.2	48.4	3278.1	162.8	23.77	23.36	0.379
6	13.2	13.2	42.4	3235.7	205.2	20.82	20.46	0.379
7	15.3	15.3	48.1	3187.6	253.3	23.62	23.21	0.379
8	17.3	17.3	72.8	3114.8	326.1	35.75	35.13	0.379
9	19.3	19.3	115.4	2999.4	441.5	56.67	55.69	0.379
10	21.4	21.4	163.0	2836.4	604.5	80.04	78.66	0.379
11	23.4	23.4	197.7	2638.7	802.2	97.08	95.41	0.379
12	25.5	25.5	225.9	2412.8	1028.1	110.93	109.02	0.379
13	27.5	27.5	275.9	2136.9	1304.0	135.49	133.15	0.379
14	29.5	29.5	349.3	1787.6	1653.3	171.53	168.57	0.379
15	31.6	31.6	408.1	1379.5	2061.4	200.41	196.95	0.379
16	33.6	33.6	430.7	948.8	2492.1	211.50	207.85	0.379
Avg. Shaft			155.8			74.17	72.89	0.379
Toe			948.8				11514.97	0.084

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	3.708	13.790
Case Damping Factor		2.336	0.198
Damping Type			Smith
Unloading Quake	(% of loading quake)	30	102
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	7	
Resistance Gap (included in Toe Quake)	(mm)		2.920
Soil Plug Weight	(kN)		0.00
Soil Support Dashpot		5.810	0.000
Soil Support Weight	(kN)	10.36	0.00

CAPWAP match quality = 1.02 (Wave Up Match) ; RSA = 0
Observed: final set = 8.000 mm; blow count = 125 b/m
Computed: final set = 8.188 mm; blow count = 122 b/m

max. Top Comp. Stress = 388.4 MPa (T= 33.8 ms, max= 1.008 x Top)
max. Comp. Stress = 391.7 MPa (Z= 7.1 m, T= 35.0 ms)
max. Tens. Stress = -18.76 MPa (Z= 15.3 m, T= 67.2 ms)
max. Energy (EMX) = 140.74 kJ; max. Measured Top Displ. (DMX)=56.37 mm

Zatelliitin koepaalutus; Pile: ZPT5 Test: 31-Mar-2015 14:16:
Vapaapudotusjarkale 9t; Blow: 8 CAPWAP(R) 2006-2
Inspecta OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	3830.3	-0.2	388.4	-0.02	140.74	7.4	53.930
2	2.0	3843.7	-16.6	389.8	-1.68	138.67	7.4	52.499
4	4.1	3846.3	-70.3	390.0	-7.13	134.32	7.2	49.603
6	6.1	3838.3	-106.6	389.2	-10.80	127.57	7.0	46.663
8	8.1	3784.8	-124.4	383.8	-12.61	118.58	6.8	43.708
10	10.2	3685.0	-138.5	373.7	-14.05	108.98	6.6	40.749
12	12.2	3596.5	-151.1	364.7	-15.32	100.12	6.4	37.785
14	14.3	3532.4	-168.2	358.2	-17.06	92.30	6.1	34.852
16	16.3	3468.4	-170.8	351.7	-17.32	84.53	5.7	31.935
18	18.3	3388.5	-157.6	343.6	-15.98	76.15	5.2	29.171
20	20.4	3240.7	-124.1	328.6	-12.59	66.62	4.6	26.537
22	22.4	3058.4	-70.3	310.1	-7.13	56.55	4.1	24.102
24	24.4	2849.1	-5.3	288.9	-0.54	46.89	3.5	21.840
25	25.5	2877.1	-15.2	291.7	-1.54	45.68	3.2	20.747
26	26.5	2584.6	-0.1	262.1	-0.01	37.99	2.9	19.743
27	27.5	2633.1	-0.1	267.0	-0.01	37.09	2.8	18.799
28	28.5	2311.9	-0.1	234.4	-0.01	29.68	2.8	17.966
29	29.5	2299.9	-0.1	233.2	-0.01	29.01	2.5	17.153
30	30.5	1884.3	-0.1	191.1	-0.01	21.53	2.4	16.479
31	31.6	1892.8	-0.1	191.9	-0.01	21.10	2.2	15.821
32	32.6	1404.6	-0.1	142.4	-0.01	13.82	2.2	15.245
33	33.6	1425.0	-0.0	144.5	-0.00	6.34	2.0	14.676
Absolute	7.1			391.7			(T =	35.0 ms)
	15.3				-18.76		(T =	67.2 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	4387.3	4216.4	4045.4	3874.5	3703.5	3532.6	3361.7	3190.7	3019.8	2848.8
RX	4387.3	4216.4	4045.4	3874.5	3703.5	3532.6	3399.9	3293.0	3186.2	3079.3
RU	4387.3	4216.4	4045.4	3874.5	3703.5	3532.6	3361.7	3190.7	3019.8	2848.8

RAU = 2954.8 (kN); RA2 = 3147.1 (kN)

Current CAPWAP Ru = 3440.9 (kN); Corresponding J(RP)= 0.55; J(RX) = 0.57

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
7.52	22.46	3040.5	3056.2	3820.6	56.372	7.998	8.000	144.9	4502.5

Zatelliitin koepaalutus; Pile: ZPT5 Test: 31-Mar-2015 14:16:
Vapaapudotusjarkale 9t; Blow: 8 CAPWAP(R) 2006-2
Inspecta OP: TRe

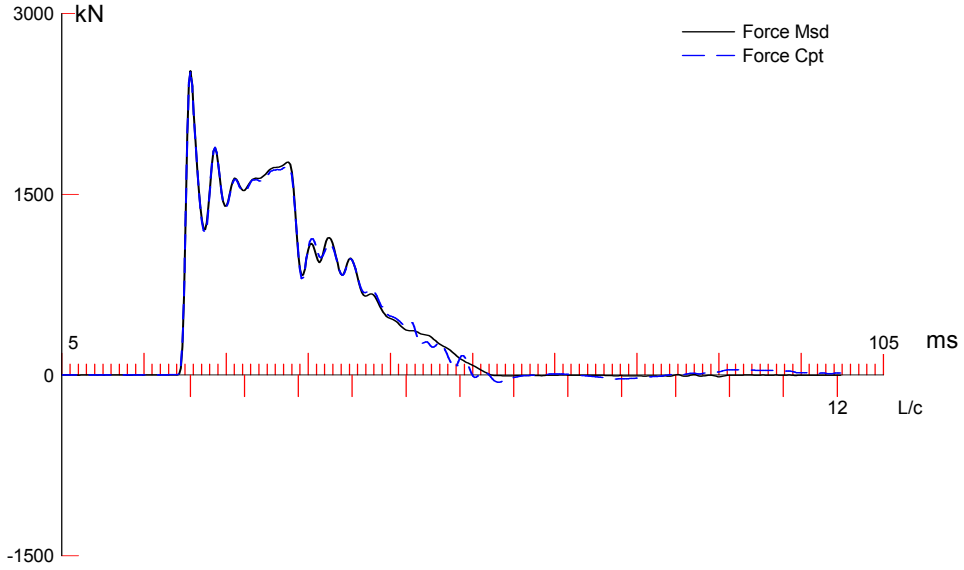
PILE PROFILE AND PILE MODEL

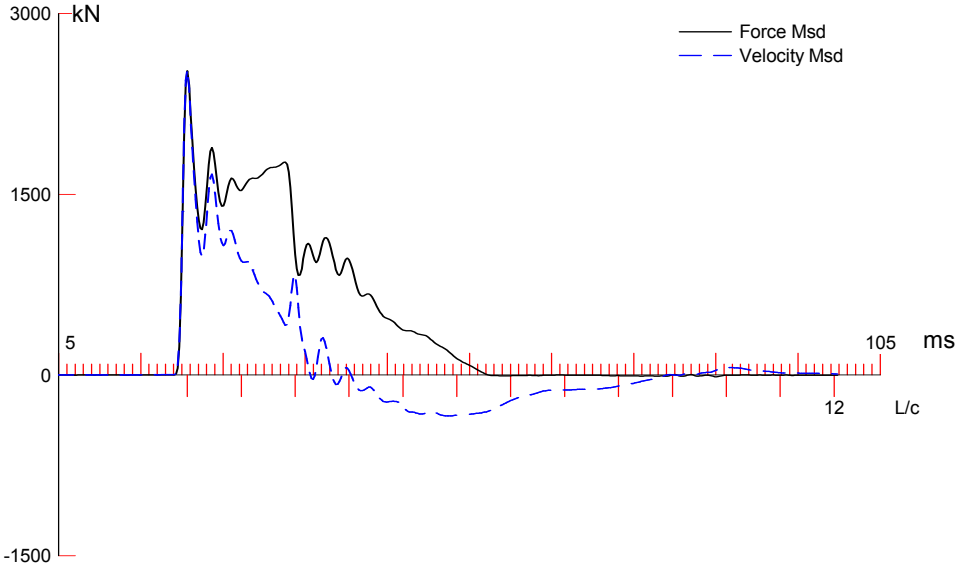
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
33.60	98.61	210000.0	78.500	1.018

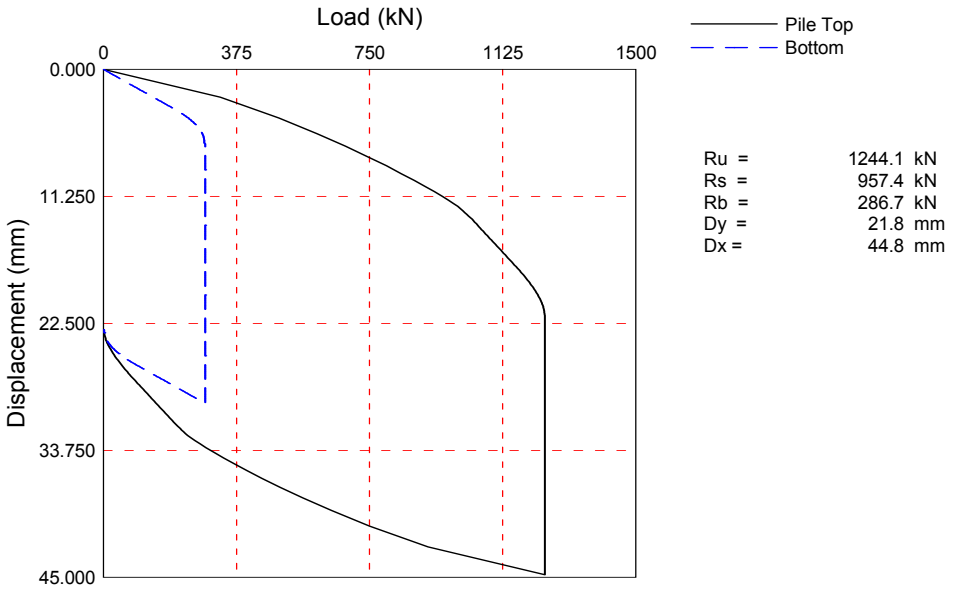
Toe Area 0.082 m^2

Top Segment Length 1.02 m, Top Impedance 404.32 kN/m/s

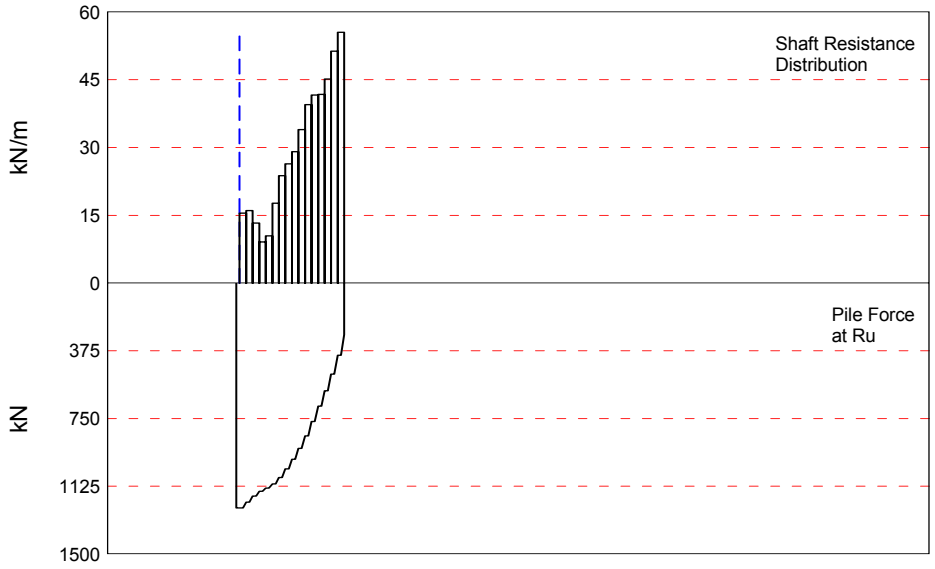
Pile Damping 1.0 %, Time Incr 0.199 ms, Wave Speed 5121.9 m/s, 2L/c 13.1 ms







Ru = 1244.1 kN
Rs = 957.4 kN
Rb = 286.7 kN
Dy = 21.8 mm
Dx = 44.8 mm



CAPWAP(R) 2006-2 Licensed to Tampere University of Technology

Koepaalutus Zatelliitti; Pile: ZPT5 24h — Test: 03-Mar-2015 12:33:
Junttan HHK 5A; Blow: 16 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1244.1; along Shaft 957.4; at Toe 286.7 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				1244.1				
1	3.1	1.5	31.5	1212.6	31.5	21.66	21.28	0.335
2	5.1	3.5	32.7	1179.9	64.2	16.06	15.78	0.335
3	7.1	5.5	27.1	1152.8	91.3	13.31	13.08	0.335
4	9.2	7.6	18.5	1134.3	109.8	9.08	8.93	0.335
5	11.2	9.6	21.3	1113.0	131.1	10.46	10.28	0.335
6	13.2	11.6	36.0	1077.0	167.1	17.68	17.37	0.335
7	15.3	13.7	48.4	1028.6	215.5	23.77	23.36	0.335
8	17.3	15.7	53.7	974.9	269.2	26.37	25.92	0.335
9	19.3	17.7	59.2	915.7	328.4	29.07	28.57	0.335
10	21.4	19.8	69.2	846.5	397.6	33.98	33.40	0.335
11	23.4	21.8	80.4	766.1	478.0	39.48	38.80	0.335
12	25.5	23.9	84.8	681.3	562.8	41.64	40.92	0.335
13	27.5	25.9	85.1	596.2	647.9	41.79	41.07	0.335
14	29.5	27.9	91.9	504.3	739.8	45.13	44.35	0.335
15	31.6	30.0	104.5	399.8	844.3	51.32	50.43	0.335
16	33.6	32.0	113.1	286.7	957.4	55.54	54.58	0.335
Avg. Shaft			59.8			29.92	29.40	0.335
Toe			286.7				3479.49	0.081

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	1.004	5.041
Case Damping Factor		0.793	0.057
Unloading Quake	(% of loading quake)	30	107
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Soil Plug Weight	(kN)		0.29
Soil Support Dashpot		1.798	5.276
Soil Support Weight	(kN)	10.36	10.36

CAPWAP match quality = 1.80 (Wave Up Match) ; RSA = 0
Observed: final set = 23.000 mm; blow count = 43 b/m
Computed: final set = 27.786 mm; blow count = 36 b/m

max. Top Comp. Stress = 257.3 MPa (T= 21.1 ms, max= 1.018 x Top)
max. Comp. Stress = 261.9 MPa (Z= 3.1 m, T= 21.5 ms)
max. Tens. Stress = -7.33 MPa (Z= 3.1 m, T= 58.0 ms)
max. Energy (EMX) = 64.80 kJ; max. Measured Top Displ. (DMX)=39.38 mm

Koepaalutus Zatelliitti; Pile: ZPT5 24h — Test: 03-Mar-2015 12:33:
Junttan HHK 5A; Blow: 16 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2537.1	-66.4	257.3	-6.73	64.80	6.2	39.248
2	2.0	2564.5	-71.6	260.0	-7.26	64.60	6.2	38.822
4	4.1	2514.9	-64.0	255.0	-6.49	61.91	6.0	37.994
6	6.1	2456.5	-48.6	249.1	-4.93	59.23	5.9	37.177
8	8.1	2404.2	-46.1	243.8	-4.68	57.04	5.8	36.407
10	10.2	2377.6	-44.1	241.1	-4.47	55.51	5.8	35.677
12	12.2	2359.1	-42.7	239.2	-4.33	53.86	5.6	34.965
14	14.3	2316.6	-46.1	234.9	-4.68	51.37	5.5	34.288
16	16.3	2249.8	-42.4	228.1	-4.30	48.25	5.3	33.628
18	18.3	2177.4	-39.5	220.8	-4.01	44.89	5.1	32.904
20	20.4	2102.7	-36.9	213.2	-3.74	41.40	4.9	32.292
22	22.4	2017.5	-33.2	204.6	-3.37	37.55	4.6	31.770
24	24.4	1915.5	-29.0	194.2	-2.94	33.29	4.4	31.360
25	25.5	1963.3	-28.6	199.1	-2.90	33.23	4.3	31.136
26	26.5	1808.5	-24.3	183.4	-2.47	28.86	4.2	30.918
27	27.5	1856.6	-24.5	188.3	-2.49	28.79	4.0	30.669
28	28.5	1709.1	-20.3	173.3	-2.06	24.49	3.9	30.432
29	29.5	1761.1	-20.3	178.6	-2.06	24.46	3.8	30.286
30	30.5	1599.3	-39.3	162.2	-3.99	20.03	3.7	30.153
31	31.6	1514.5	-19.0	153.6	-1.92	20.01	4.3	30.007
32	32.6	983.8	-13.2	99.8	-1.34	14.96	5.1	29.876
33	33.6	637.3	-16.4	64.6	-1.66	9.36	5.4	29.720
Absolute	3.1			261.9			(T =	21.5 ms)
	3.1				-7.33		(T =	58.0 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	2667.2	2422.7	2178.2	1933.7	1689.2	1444.7	1200.2	955.7	711.1	466.6
RX	2667.2	2422.7	2178.2	1933.7	1689.2	1487.3	1362.7	1266.4	1191.2	1132.1
RU	2667.2	2422.7	2178.2	1933.7	1689.2	1444.7	1200.2	955.7	711.1	466.6

RAU = 297.1 (kN); RA2 = 1608.7 (kN)

Current CAPWAP Ru = 1244.1 (kN); Corresponding J(RP)= 0.58; J(RX) = 0.73

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
6.34	20.87	2563.0	2549.3	2549.3	39.378	23.031	23.000	64.9	2080.6

Koepaalutus Zatelliitti; Pile: ZPT5 24h — Test: 03-Mar-2015 12:33:
Junttan HHK 5A; Blow: 16 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

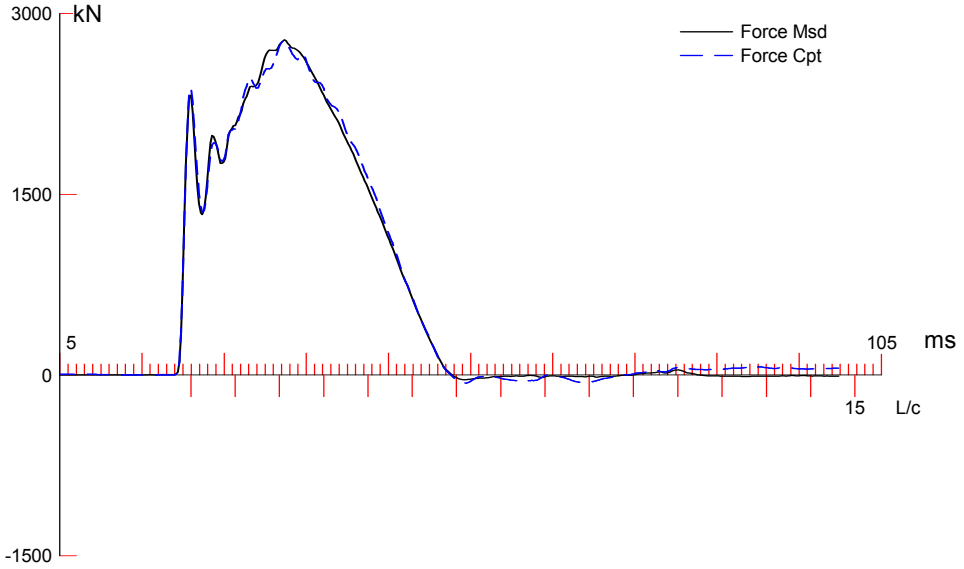
PILE PROFILE AND PILE MODEL

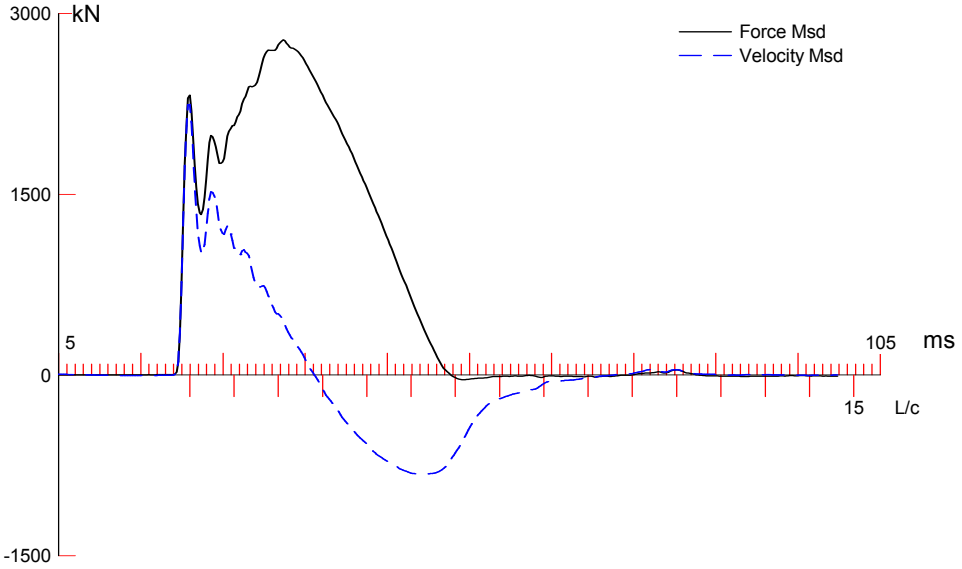
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
33.60	98.61	210000.0	78.500	1.018

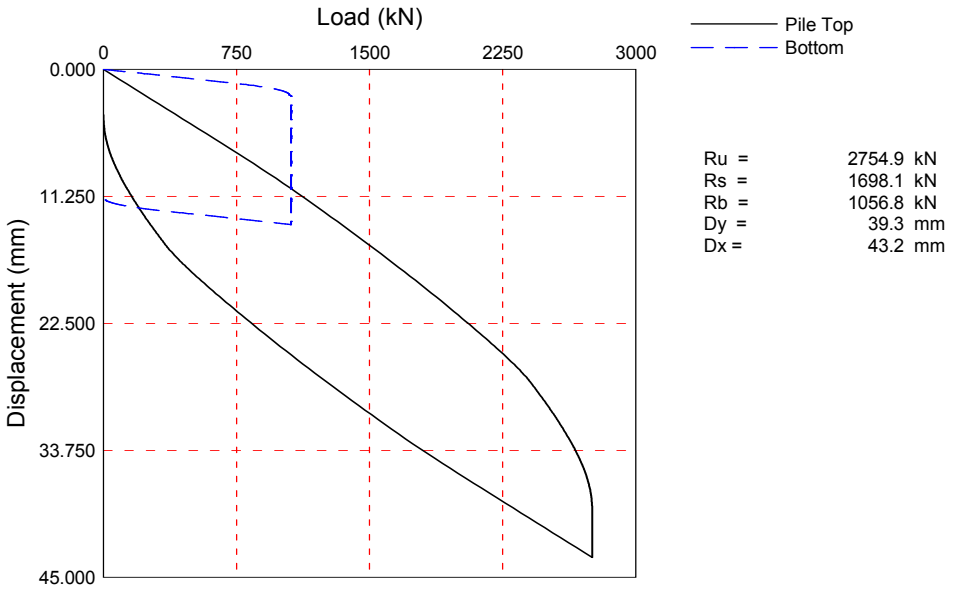
Toe Area 0.082 m^2

Top Segment Length 1.02 m, Top Impedance 404.32 kN/m/s

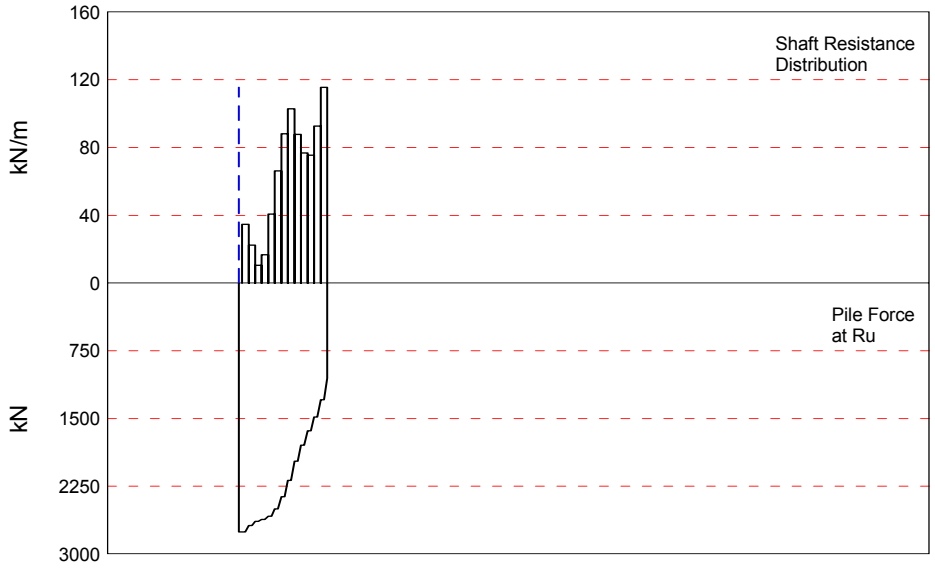
Pile Damping 1.0 %, Time Incr 0.199 ms, Wave Speed 5121.9 m/s, 2L/c 13.1 ms







Ru = 2754.9 kN
Rs = 1698.1 kN
Rb = 1056.8 kN
Dy = 39.3 mm
Dx = 43.2 mm



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Zatelliitin koepaalutus 14vrk; Pile: ZPT6 14 vrk — Test: 18-Mar-2015 09:51:
Junttan HHK 7A; Blow: 17 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 2754.9; along Shaft 1698.1; at Toe 1056.8 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				2754.9				
1	3.1	3.1	70.8	2684.1	70.8	23.09	22.69	0.410
2	5.1	5.1	46.0	2638.1	116.8	22.50	22.11	0.410
3	7.2	7.2	21.5	2616.6	138.3	10.52	10.33	0.410
4	9.2	9.2	34.3	2582.3	172.6	16.78	16.49	0.410
5	11.2	11.2	83.3	2499.0	255.9	40.74	40.04	0.410
6	13.3	13.3	135.5	2363.5	391.4	66.28	65.13	0.410
7	15.3	15.3	180.0	2183.5	571.4	88.04	86.52	0.410
8	17.4	17.4	210.3	1973.2	781.7	102.86	101.09	0.410
9	19.4	19.4	179.4	1793.8	961.1	87.75	86.24	0.410
10	21.5	21.5	157.0	1636.8	1118.1	76.79	75.47	0.410
11	23.5	23.5	154.4	1482.4	1272.5	75.52	74.22	0.410
12	25.6	25.6	189.6	1292.8	1462.1	92.74	91.14	0.410
13	27.6	27.6	236.0	1056.8	1698.1	115.43	113.44	0.410
Avg. Shaft			130.6			61.53	60.46	0.410
Toe			1056.8				12825.69	1.313

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	7.500	1.772
Case Damping Factor		1.723	3.431
Damping Type			Smith
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Soil Plug Weight	(kN)		2.36
Soil Support Dashpot		0.000	3.010
Soil Support Weight	(kN)	0.00	10.40

CAPWAP match quality = 1.19 (Force Match) ; RSA = 0
Observed: final set = 4.000 mm; blow count = 250 b/m
Computed: final set = 7.057 mm; blow count = 142 b/m

max. Top Comp. Stress = 281.3 MPa (T= 32.5 ms, max= 1.011 x Top)
max. Comp. Stress = 284.4 MPa (Z= 3.1 m, T= 32.7 ms)
max. Tens. Stress = -18.05 MPa (Z= 11.2 m, T= 56.1 ms)
max. Energy (EMX) = 72.99 kJ; max. Measured Top Displ. (DMX)=36.06 mm

Zatelliitin koepaalutus 14vrk; Pile: ZPT6 14 vrk — Test: 18-Mar-2015 09:51:
Junttan HHK 7A; Blow: 17 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2774.5	-67.4	281.3	-6.84	72.99	5.4	34.852
2	2.0	2803.7	-110.3	284.3	-11.18	71.75	5.4	33.621
4	4.1	2710.6	-113.8	274.9	-11.54	64.19	5.2	31.175
6	6.1	2715.6	-124.9	275.4	-12.67	58.68	5.2	28.806
8	8.2	2682.6	-148.3	272.0	-15.04	54.69	5.1	26.431
10	10.2	2641.2	-164.3	267.8	-16.66	50.40	4.9	24.116
12	12.3	2566.9	-156.6	260.3	-15.88	44.72	4.5	21.892
13	13.3	2557.7	-169.0	259.4	-17.13	43.51	4.3	20.814
14	14.3	2384.8	-127.5	241.8	-12.93	38.22	4.2	19.823
15	15.3	2410.7	-139.9	244.5	-14.19	37.21	3.9	18.836
16	16.4	2206.4	-87.9	223.7	-8.92	31.64	3.7	17.944
17	17.4	2211.2	-100.3	224.2	-10.17	30.88	3.5	17.084
18	18.4	1952.2	-59.8	198.0	-6.07	25.67	3.4	16.336
19	19.4	1936.0	-61.2	196.3	-6.21	25.11	3.2	15.603
20	20.4	1727.7	-52.5	175.2	-5.32	21.31	3.1	14.982
21	21.5	1749.5	-53.8	177.4	-5.45	20.96	3.0	14.408
22	22.5	1564.7	-44.6	158.7	-4.52	18.11	2.9	13.926
23	23.5	1555.1	-44.1	157.7	-4.48	17.90	2.7	13.481
24	24.5	1357.1	-33.5	137.6	-3.39	15.50	2.6	13.116
25	25.6	1468.0	-32.3	148.9	-3.28	15.37	2.3	12.774
26	26.6	1353.8	-19.3	137.3	-1.96	12.91	2.0	12.559
27	27.6	1417.7	-19.1	143.8	-1.93	10.16	1.8	12.360
Absolute	3.1			284.4			(T =	32.7 ms)
	11.2				-18.05		(T =	56.1 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	3429.9	3309.7	3189.4	3069.1	2948.8	2828.5	2708.3	2588.0	2467.7	2347.4
RX	3429.9	3309.7	3189.4	3069.1	2948.8	2828.5	2708.3	2618.3	2564.9	2514.4
RU	3429.9	3309.7	3189.4	3069.1	2948.8	2828.5	2708.3	2588.0	2467.7	2347.4

RAU = 2376.7 (kN); RA2 = 2518.2 (kN)

Current CAPWAP Ru = 2754.9 (kN); Corresponding J(RP)= 0.56; J(RX) = 0.56

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
5.65	21.16	2282.6	2350.2	2786.3	36.060	4.201	4.000	74.9	3737.2

PILE PROFILE AND PILE MODEL

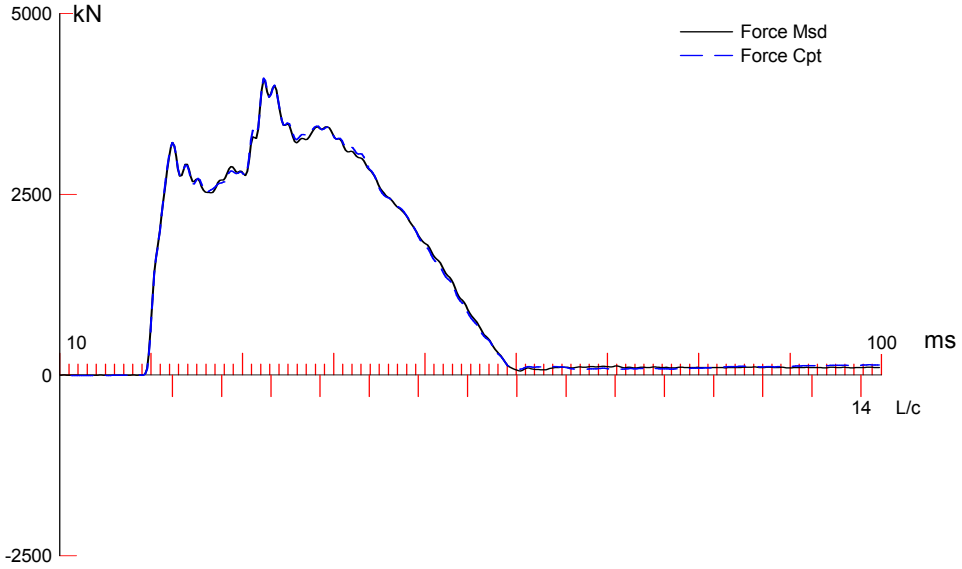
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
27.60	98.61	210000.0	78.500	1.018

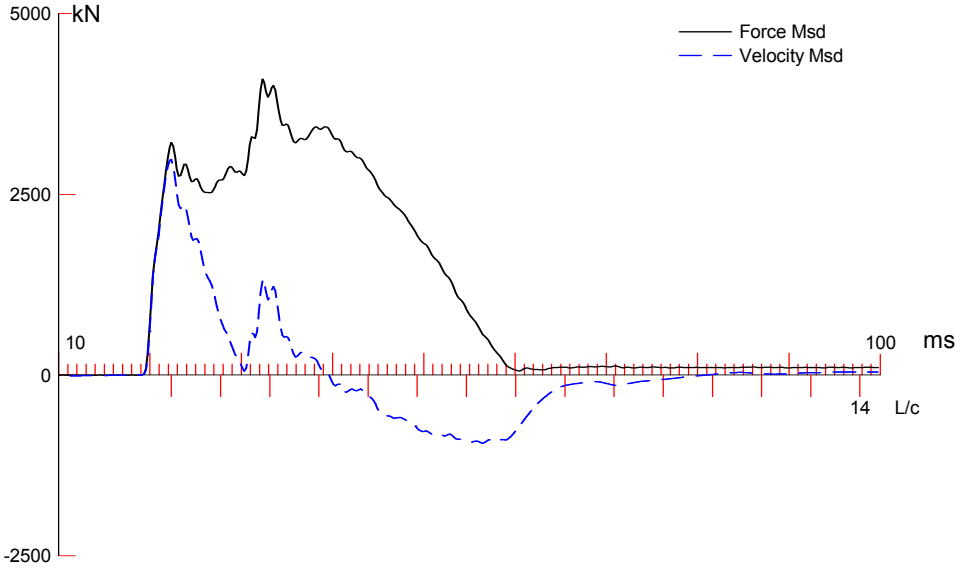
Zatelliitin koepaalutus 14vrk; Pile: ZPT6 14 vrk Test: 18-Mar-2015 09:51:
Junttan HHK 7A; Blow: 17 CAPWAP(R) 2006-2
Inspecta OP: TRe

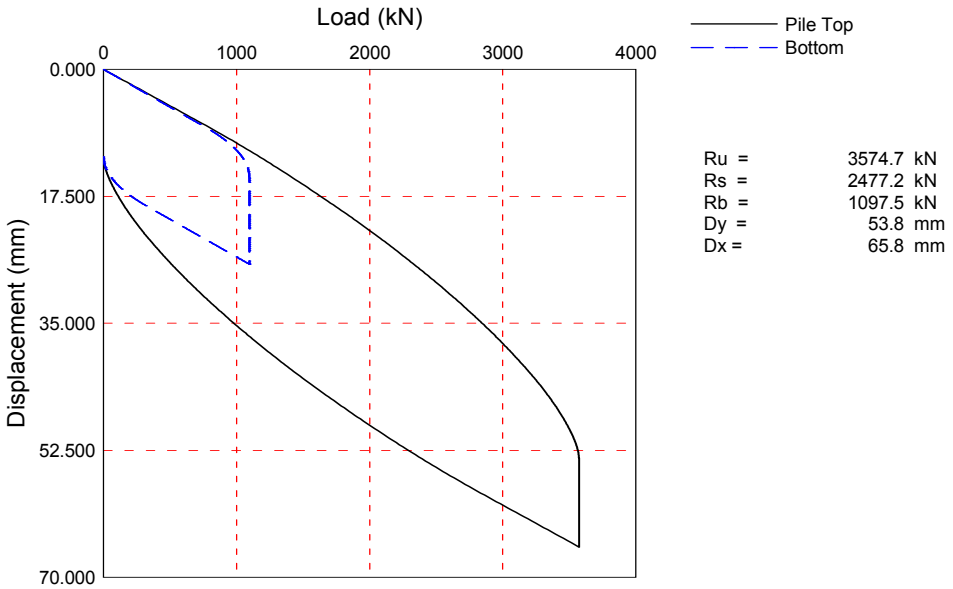
Toe Area 0.082 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.02	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.04	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.05
27	27.60	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.05

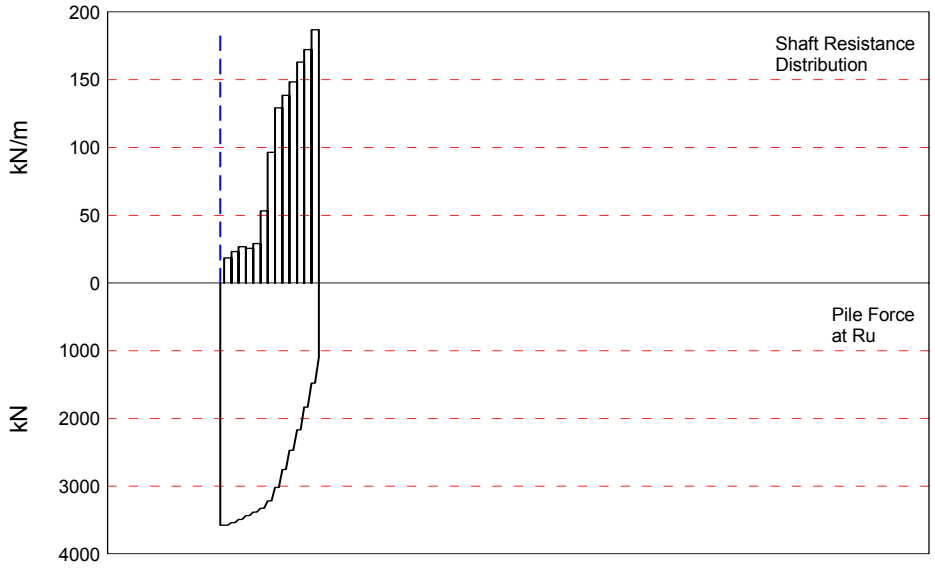
Pile Damping 1.0 %, Time Incr 0.200 ms, Wave Speed 5121.9 m/s, 2L/c 10.8 ms







Ru =	3574.7	kN
Rs =	2477.2	kN
Rb =	1097.5	kN
Dy =	53.8	mm
Dx =	65.8	mm



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Zatelliitin koepaalutus; Pile: ZPT6 28vrk — Test: 31-Mar-2015 13:50:
Vapaapudotusjarkale 9t; Blow: 14 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 3574.7; along Shaft 2477.2; at Toe 1097.5 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m
				3574.7				
1	3.1	3.1	37.7	3537.0	37.7	12.29	12.08	0.443
2	5.1	5.1	47.9	3489.1	85.6	23.43	23.03	0.443
3	7.2	7.2	55.0	3434.1	140.6	26.90	26.44	0.443
4	9.2	9.2	52.6	3381.5	193.2	25.73	25.28	0.443
5	11.2	11.2	59.8	3321.7	253.0	29.25	28.75	0.443
6	13.3	13.3	108.8	3212.9	361.8	53.22	52.30	0.443
7	15.3	15.3	197.1	3015.8	558.9	96.41	94.74	0.443
8	17.4	17.4	264.2	2751.6	823.1	129.23	127.00	0.443
9	19.4	19.4	283.0	2468.6	1106.1	138.42	136.04	0.443
10	21.5	21.5	303.4	2165.2	1409.5	148.40	145.84	0.443
11	23.5	23.5	333.6	1831.6	1743.1	163.17	160.36	0.443
12	25.6	25.6	352.0	1479.6	2095.1	172.17	169.20	0.443
13	27.6	27.6	382.1	1097.5	2477.2	186.90	183.67	0.443
Avg. Shaft			190.6			89.75	88.20	0.443
Toe			1097.5				13319.64	0.061

Soil Model Parameters/Extensions		Shaft	Toe
Quake	(mm)	7.501	11.422
Case Damping Factor		2.714	0.166
Damping Type			Smith
Unloading Quake	(% of loading quake)	46	100
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	0	
Resistance Gap (included in Toe Quake)	(mm)		0.007
Soil Plug Weight	(kN)		2.21
Soil Support Dashpot		3.500	10.000
Soil Support Weight	(kN)	10.40	10.40

CAPWAP match quality = 1.14 (Wave Up Match) ; RSA = 0
Observed: final set = 12.000 mm; blow count = 83 b/m
Computed: final set = 7.129 mm; blow count = 140 b/m

max. Top Comp. Stress = 416.2 MPa (T= 32.7 ms, max= 1.000 x Top)
max. Comp. Stress = 416.2 MPa (Z= 1.0 m, T= 32.7 ms)
max. Tens. Stress = -11.96 MPa (Z= 13.3 m, T= 63.3 ms)
max. Energy (EMX) = 144.13 kJ; max. Measured Top Displ. (DMX)=51.33 mm

Zatelliitin koepaalutus; Pile: ZPT6 28vrk — Test: 31-Mar-2015 13:50:
Vapaapudotusjarkale 9t; Blow: 14 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	4103.9	-7.0	416.2	-0.71	144.13	7.3	49.423
2	2.0	4100.1	-7.1	415.8	-0.72	141.23	7.2	47.724
4	4.1	4035.4	-10.0	409.2	-1.02	130.77	6.9	44.339
6	6.1	3987.3	-34.5	404.3	-3.50	119.80	6.7	40.987
8	8.2	3912.8	-55.9	396.8	-5.67	109.09	6.4	37.733
10	10.2	3857.7	-83.2	391.2	-8.43	99.72	5.9	34.629
12	12.3	3823.0	-96.3	387.7	-9.77	91.13	5.3	31.732
13	13.3	3859.4	-118.0	391.4	-11.96	89.01	5.0	30.290
14	14.3	3710.4	-91.3	376.3	-9.26	80.58	4.7	28.896
15	15.3	3745.4	-108.7	379.8	-11.02	78.61	4.4	27.503
16	16.4	3462.9	-48.4	351.2	-4.91	67.60	4.1	26.187
17	17.4	3493.1	-65.5	354.2	-6.64	65.83	3.8	24.868
18	18.4	3148.7	-5.6	319.3	-0.56	54.50	3.5	23.657
19	19.4	3179.4	-5.6	322.4	-0.57	53.03	3.2	22.455
20	20.4	2852.0	-4.7	289.2	-0.47	43.29	3.0	21.400
21	21.5	2868.4	-4.6	290.9	-0.47	42.22	2.7	20.378
22	22.5	2463.6	-3.7	249.8	-0.37	33.77	2.4	19.468
23	23.5	2503.6	-3.7	253.9	-0.37	32.94	2.4	18.564
24	24.5	2093.4	-2.6	212.3	-0.26	25.35	2.5	17.801
25	25.6	2037.3	-2.5	206.6	-0.25	24.79	2.5	17.059
26	26.6	1649.7	-1.5	167.3	-0.15	17.92	2.5	16.426
27	27.6	1629.5	-1.4	165.2	-0.15	10.91	2.4	15.834
Absolute	1.0			416.2			(T =	32.7 ms)
	13.3				-11.96		(T =	63.3 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	4525.4	4355.2	4185.1	4015.0	3844.9	3674.8	3504.7	3334.6	3164.5	2994.4
RX	4525.4	4355.2	4185.1	4015.0	3871.1	3756.3	3641.6	3526.8	3414.0	3390.1
RU	4525.4	4355.2	4185.1	4015.0	3844.9	3674.8	3504.7	3334.6	3164.5	2994.4

RAU = 3388.4 (kN); RA2 = 3724.3 (kN)

Current CAPWAP Ru = 3574.7 (kN); Corresponding J(RP)= 0.56; J(RX) = 0.66

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
7.43	22.55	3003.0	3223.5	4122.7	51.329	11.990	12.000	148.3	4683.1

PILE PROFILE AND PILE MODEL

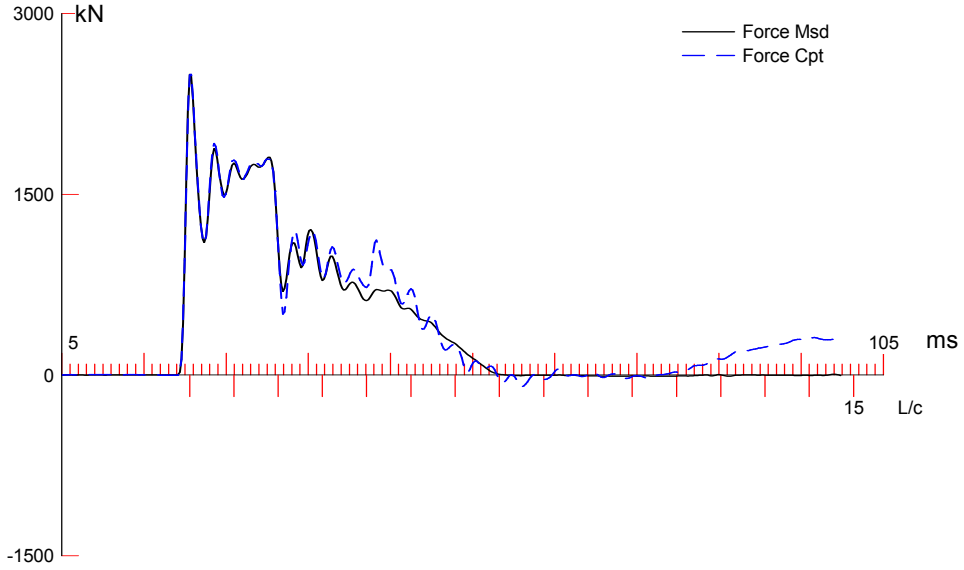
Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
27.60	98.61	210000.0	78.500	1.018

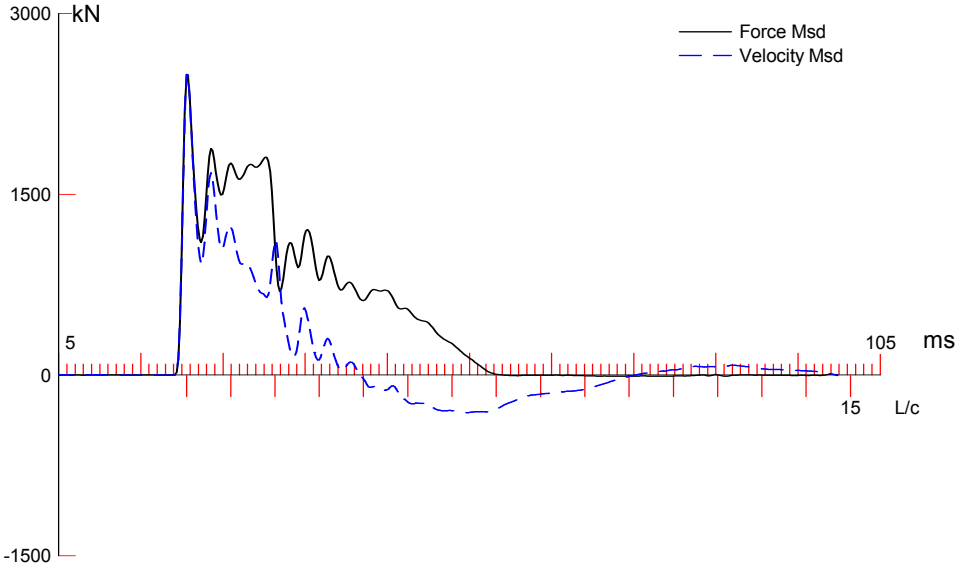
Zatelliitin koepaalutus; Pile: ZPT6 28vrk — Test: 31-Mar-2015 13:50:
Vapaapudotusjarkale 9t; Blow: 14 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

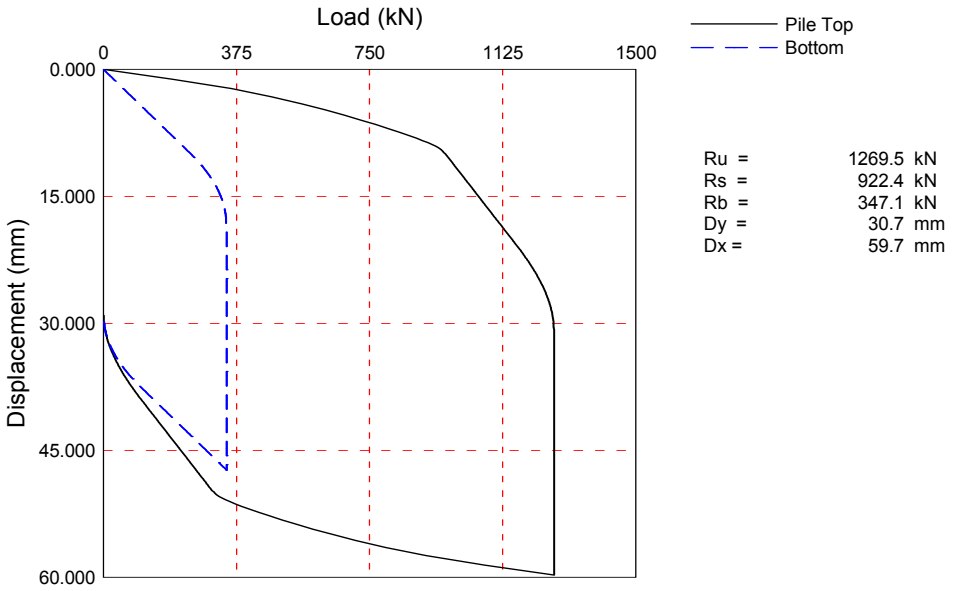
Toe Area 0.082 m^2

Segmnt Number	Dist. B.G. m	Impedance kN/m/s	Imped. Change %	Tension Slack mm	Tension Eff.	Compression Slack mm	Compression Eff.	Perim. m	Soil Plug kN
1	1.02	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.00
2	2.04	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02
3	3.07	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02
27	27.60	404.32	0.00	0.000	0.000	-0.000	0.000	1.018	0.02

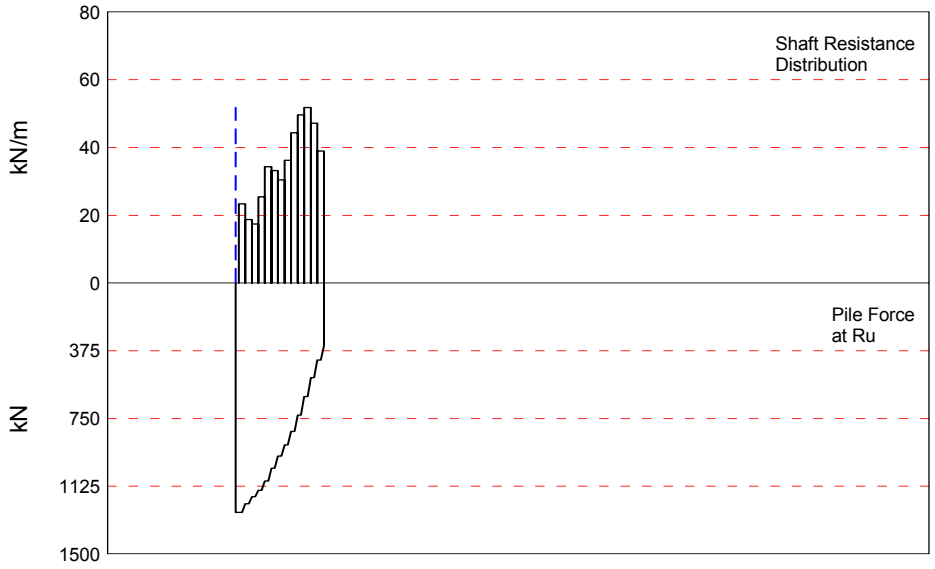
Pile Damping 1.0 %, Time Incr 0.200 ms, Wave Speed 5121.9 m/s, 2L/c 10.8 ms







Ru	=	1269.5 kN
Rs	=	922.4 kN
Rb	=	347.1 kN
Dy	=	30.7 mm
Dx	=	59.7 mm



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Koepaalutus Zatelliitti; Pile: ZPT6 24h — Test: 03-Mar-2015 12:14:
Junttan HHK 5A; Blow: 18 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

CAPWAP SUMMARY RESULTS

Total CAPWAP Capacity: 1269.5; along Shaft 922.4; at Toe 347.1 kN

Soil Sgmnt No.	Dist. Below Gages m	Depth Below Grade m	Ru kN	Force in Pile kN	Sum of Ru kN	Unit Resist. (Depth) kN/m	Unit Resist. (Area) kPa	Smith Damping Factor s/m	Quake mm
				1269.5					
1	3.1	3.1	47.9	1221.6	47.9	15.62	15.35	0.217	1.210
2	5.1	5.1	38.4	1183.2	86.3	18.78	18.46	0.217	1.211
3	7.2	7.2	35.7	1147.5	122.0	17.46	17.16	0.217	1.211
4	9.2	9.2	52.0	1095.5	174.0	25.43	25.00	0.217	1.211
5	11.2	11.2	70.2	1025.3	244.2	34.34	33.74	0.217	1.211
6	13.3	13.3	67.8	957.5	312.0	33.16	32.59	0.217	1.211
7	15.3	15.3	62.2	895.3	374.2	30.42	29.90	0.217	1.211
8	17.4	17.4	74.0	821.3	448.2	36.20	35.57	0.217	1.211
9	19.4	19.4	90.6	730.7	538.8	44.32	43.55	0.217	1.211
10	21.5	21.5	101.6	629.1	640.4	49.70	48.84	0.217	1.211
11	23.5	23.5	105.9	523.2	746.3	51.80	50.91	0.217	1.211
12	25.6	25.6	96.4	426.8	842.7	47.15	46.34	0.217	1.211
13	27.6	27.6	79.7	347.1	922.4	38.98	38.31	0.217	1.211
Avg. Shaft			71.0			33.42	32.84	0.217	1.211
Toe			347.1				4212.53	0.174	14.070

Soil Model Parameters/Extensions		Shaft	Toe
Case Damping Factor		0.495	0.149
Unloading Quake	(% of loading quake)	180	60
Reloading Level	(% of Ru)	100	100
Unloading Level	(% of Ru)	19	
Soil Plug Weight	(kN)		0.43
Soil Support Dashpot		1.000	0.000
Soil Support Weight	(kN)	10.40	0.00

CAPWAP match quality = 2.00 (Force Match) ; RSA = 0
Observed: final set = 29.000 mm; blow count = 34 b/m
Computed: final set = 27.127 mm; blow count = 37 b/m

max. Top Comp. Stress = 252.9 MPa (T= 21.0 ms, max= 1.026 x Top)
max. Comp. Stress = 259.4 MPa (Z= 3.1 m, T= 21.6 ms)
max. Tens. Stress = -28.18 MPa (Z= 24.5 m, T= 27.1 ms)
max. Energy (EMX) = 64.03 kJ; max. Measured Top Displ. (DMX)=40.65 mm

Koepaalutus Zatelliitti; Pile: ZPT6 24h — Test: 03-Mar-2015 12:14:
Junttan HHK 5A; Blow: 18 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

EXTREMA TABLE

Pile Sgmnt No.	Dist. Below Gages m	max. Force kN	min. Force kN	max. Comp. Stress MPa	max. Tens. Stress MPa	max. Trnsfd. Energy kJ	max. Veloc. m/s	max. Displ. mm
1	1.0	2494.2	-95.9	252.9	-9.73	64.03	6.1	40.283
2	2.0	2541.8	-86.7	257.8	-8.79	64.29	6.1	39.897
4	4.1	2476.4	-69.0	251.1	-7.00	60.99	5.9	39.069
6	6.1	2429.7	-89.7	246.4	-9.10	58.26	5.8	38.176
8	8.2	2403.6	-68.8	243.7	-6.97	55.89	5.7	37.441
10	10.2	2360.1	-25.8	239.3	-2.61	52.65	5.5	36.681
12	12.3	2279.8	-26.3	231.2	-2.67	48.42	5.3	35.764
13	13.3	2306.6	-33.0	233.9	-3.35	48.15	5.3	35.258
14	14.3	2201.2	-12.7	223.2	-1.28	44.38	5.2	34.822
15	15.3	2229.8	-12.2	226.1	-1.24	44.22	5.1	34.443
16	16.4	2143.6	-1.8	217.4	-0.18	40.91	5.0	34.127
17	17.4	2178.0	-1.8	220.9	-0.18	40.78	4.9	33.785
18	18.4	2077.6	-1.5	210.7	-0.15	37.02	4.8	33.517
19	19.4	2117.7	-1.5	214.7	-0.15	36.93	4.7	33.240
20	20.4	1991.7	-1.3	202.0	-0.13	32.46	4.9	33.003
21	21.5	2035.1	-1.2	206.4	-0.12	32.43	4.8	32.827
22	22.5	1892.1	-4.1	191.9	-0.41	27.55	4.3	32.652
23	23.5	1934.9	-132.1	196.2	-13.40	27.51	4.2	32.454
24	24.5	1768.0	-277.9	179.3	-28.18	22.60	4.1	32.258
25	25.6	1685.5	-99.4	170.9	-10.08	22.55	4.7	32.047
26	26.6	1193.5	-0.5	121.0	-0.05	18.03	5.7	31.854
27	27.6	772.0	-0.4	78.3	-0.04	14.10	6.3	31.663
Absolute	3.1			259.4			(T =	21.6 ms)
	24.5				-28.18		(T =	27.1 ms)

CASE METHOD

J =	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
RP	2482.3	2219.8	1957.2	1694.6	1432.0	1169.5	906.9	644.3	381.8	119.2
RX	2482.3	2219.8	1957.2	1694.6	1470.2	1337.4	1219.2	1127.0	1054.4	987.9
RU	2482.3	2219.8	1957.2	1694.6	1432.0	1169.5	906.9	644.3	381.8	119.2

RAU = 261.7 (kN); RA2 = 1589.5 (kN)

Current CAPWAP Ru = 1269.5 (kN); Corresponding J(RP)= 0.46; J(RX) = 0.56

VMX m/s	TVP ms	VT1*Z kN	FT1 kN	FMX kN	DMX mm	DFN mm	SET mm	EMX kJ	QUS kN
6.31	20.76	2552.7	2555.3	2555.3	40.654	29.002	29.000	64.6	1854.7

Koepaalutus Zatelliitti; Pile: ZPT6 24h — Test: 03-Mar-2015 12:14:
Junttan HHK 5A; Blow: 18 — CAPWAP(R) 2006-2
Inspecta — OP: TRe

PILE PROFILE AND PILE MODEL

Depth m	Area cm^2	E-Modulus MPa	Spec. Weight kN/m^3	Perim. m
0.00	98.61	210000.0	78.500	1.018
27.60	98.61	210000.0	78.500	1.018

Toe Area 0.082 m^2

Top Segment Length 1.02 m, Top Impedance 404.32 kN/m/s

Pile Damping 1.0 %, Time Incr 0.200 ms, Wave Speed 5121.9 m/s, 2L/c 10.8 ms

Projekti	Koepaalutus	
Kohde	Zatelliitti	
Paalu nro.	ZPT4	
Pituus	37	m
Paalumateriaali	*Teräs*	
Paalun halkaisija D	323	mm
Paalun kärjen pinta-ala	0,082	m²
Paalun pl. piiri	1,01	m

Paalun kärkivyöhykkeeksi katsotaan maakerros, joka ulottuu mitan 5D paalun kärjen yläpuolelle (min. 1 m) ja mitan 3D kärjen alapuolelle (min. 1 m)

5*D	1,615 m
3*D	1 m

	Syvyys m	Taso	N_{20} l/0,2 m	Max 15 MPa q_b MPa	Q_b MN		Max 150 KPa q_s kPa	Q_s MN	$R_{c;cal}$ MN
	0								
0-1	1	6	4		0,000	0,001	0,001	0,001	0,00
1-2	2	5	4	0,80	0,066	0,001	0,001	0,002	0,07
2-3	3	4	4	0,80	0,066	0,001	0,001	0,003	0,07
3-4	4	3	4	0,80	0,066	0,001	0,001	0,004	0,07
4-5	5	2	4	0,80	0,066	0,001	0,001	0,005	0,07
5-6	6	1	4	0,80	0,066	0,001	0,001	0,005	0,07
6-7	7	0	4	0,80	0,066	0,001	0,001	0,006	0,07
7-8	8	-1	10	1,20	0,098	0,034	0,031	0,007	0,11
8-9	9	-2	15	1,93	0,158	0,049	0,044	0,038	0,20
9-10	10	-3	20	3,00	0,246	0,063	0,056	0,083	0,33
10-11	11	-4	20	3,67	0,300	0,063	0,056	0,140	0,44
11-12	12	-5	20	4,00	0,328	0,063	0,056	0,198	0,53
12-13	13	-6	20	4,00	0,328	0,063	0,056	0,255	0,58
13-14	14	-7	20	4,00	0,328	0,063	0,056	0,312	0,64
14-15	15	-8	20	4,00	0,328	0,063	0,056	0,369	0,70
15-16	16	-9	20	4,00	0,328	0,063	0,056	0,426	0,75
16-17	17	-10	20	4,00	0,328	0,063	0,056	0,483	0,81
17-18	18	-11	20	4,00	0,328	0,063	0,056	0,540	0,87
18-19	19	-12	20	4,00	0,328	0,063	0,056	0,597	0,93
19-20	20	-13	20	4,00	0,328	0,063	0,056	0,654	0,98
20-21	21	-14	25	4,33	0,355	0,074	0,067	0,711	1,07
21-22	22	-15	30	5,00	0,410	0,083	0,075	0,779	1,19
22-23	23	-16	32	5,80	0,475	0,087	0,078	0,855	1,33
23-24	24	-17	32	6,27	0,513	0,087	0,078	0,934	1,45
24-25	25	-18	35	6,60	0,541	0,091	0,082	1,013	1,55
25-26	26	-19	40	7,13	0,585	0,096	0,087	1,096	1,68
26-27	27	-20	60	9,00	0,737	0,106	0,095	1,185	1,92
27-28	28	-21	60	10,67	0,874	0,106	0,095	1,281	2,16
28-29	29	-22	80	13,33	1,093	0,117	0,105	1,378	2,47
29-30	30	-23	100	15,00	1,229	0,128	0,115	1,485	2,71
30-31	31	-24	100	15,00	1,229	0,128	0,115	1,602	2,83
31-32	32	-25	100	15,00	1,229	0,128	0,115	1,719	2,95
32-33	33	-26	100	15,00	1,229	0,128	0,115	1,836	3,07
33-34	34	-27	100	15,00	1,229	0,128	0,115	1,954	3,18
34-35	35	-28	100	15,00	1,229	0,128	0,115	2,071	3,30
35-36	36	-29	100	15,00	1,229	0,128	0,115	2,188	3,42
36-37	**37**	**-30**	**100**	**15,00**	**1,229**	**0,128**	**0,115**	**2,305**	**3,53**
37-38	38	-31	100	15,00	1,229	0,128	0,115	2,422	3,65
	39	-32	100	15,00	1,229	0,128	0,115	2,539	3,77

Paalun kantavuus puristinkairaus-/puristin-heijarikairausvastuksen perusteella (LCPC)

LCPC method

Projekti	**Zatelliitti**		
Asiakas			
Kohde	**ZPT4**		
Paalun halkaisija	323,9 mm	Paalun pituus 37 m	
Paalun kärjen pinta-ala	0,0823553 m^2	Lähtötaso	7
Piiri	1,017046 m	Muunnoskerroin $n_{l/0,2m}$ -> qc=	0,83 (Hki/Geo/74/97)

Taso	Syv.	Maalaji	l/0,2 m	qc [Mpa]	Muunnettu qc [Mpa]	kc	α	qsmax [kPa]	**Rk [kN]**	qs [kN/m2]	Qp [kN]	Qs [kN]	Qs/Rk
6	1	Hk	0	2,0	2,0	0,5	60	35	**137**	33	103	34	0,25
5	2	Hk	0	3,0	3,0	0,5	60	35	**172**	50	103	69	0,40
4	3	Hk	0	2,0	2,0	0,5	60	35	**248**	33	144	103	0,42
3	4	Hk	0	5,0	5,0	0,5	60	80	**411**	83	226	185	0,45
2	5	Hk	0	6,0	6,0	0,5	100	80	**493**	60	247	246	0,50
1	6	Hk	0	6,0	6,0	0,5	100	80	**595**	35	288	307	0,52
0	7	Hk	40	0,0	8,0	0,5	100	80	**635**	80	247	388	0,61
-1	8	Hk	20	0,0	4,0	0,5	60	35	**630**	67	206	424	0,67
-2	9	Hk	30	0,0	6,0	0,5	100	80	**773**	60	288	485	0,63
-3	10	Hk	40	0,0	8,0	0,5	100	80	**896**	80	329	566	0,63
-4	11	Hk	40	0,0	8,0	0,5	100	80	**895**	80	247	648	0,72
-5	12	Hk	20	0,0	4,0	0,5	60	35	**889**	67	206	683	0,77
-6	13	Hk	30	0,0	6,0	0,5	100	80	**1032**	60	288	744	0,72
-7	14	sa	40	0,0	8,0	0,5	100	80	**1114**	80	288	826	0,74
-8	15	Hk	0	6,0	6,0	0,5	100	80	**1134**	60	247	887	0,78
-9	16	Hk	0	6,0	6,0	0,5	100	80	**1195**	60	247	948	0,79
-10	17	Hk	0	6,0	6,0	0,5	100	80	**1256**	60	247	1009	0,80
-11	18	Hk	0	6,0	6,0	0,5	100	80	**1317**	60	247	1070	0,81
-12	19	Hk	0	6,0	6,0	0,5	100	80	**1378**	60	247	1131	0,82
-13	20	Hk	0	6,0	6,0	0,5	100	80	**1439**	60	247	1192	0,83
-14	21	Hk	0	6,0	6,0	0,5	100	80	**1500**	60	247	1253	0,84
-15	22	Hk	0	6,0	6,0	0,5	100	80	**1561**	60	247	1314	0,84
-16	23	Hk	0	6,0	6,0	0,5	100	80	**1663**	60	288	1375	0,83
-17	24	Hk	40	0,0	8,0	0,5	100	80	**1785**	80	329	1456	0,82
-18	25	Hk	40	0,0	8,0	0,5	100	80	**1867**	80	329	1537	0,82
-19	26	Hk	40	0,0	8,0	0,5	100	80	**1948**	80	329	1619	0,83
-20	27	Hk	40	0,0	8,0	0,5	100	80	**2174**	80	474	1700	0,78
-21	28	Hk	100	0,0	15,0	0,4	150	120	**2296**	100	494	1802	0,78
-22	29	Hk	120	0,0	15,0	0,4	150	120	**2398**	100	494	1904	0,79
-23	30	Hk	140	0,0	15,0	0,4	150	120	**2499**	100	494	2005	0,80
-24	31	Hk	160	0,0	15,0	0,4	150	120	**2601**	100	494	2107	0,81
-25	32	Hk	180	0,0	15,0	0,4	150	120	**2703**	100	494	2209	0,82
-26	33	Hk	200	0,0	15,0	0,4	150	120	**2805**	100	494	2310	0,82
-27	34	Hk	220	0,0	15,0	0,4	150	120	**2906**	100	494	2412	0,83
-28	35	Hk	240	0,0	15,0	0,4	150	120	**3008**	100	494	2514	0,84
-29	36	Hk	260	0,0	15,0	0,4	150	120	**3110**	100	494	2616	0,84
-30	**37**	**Hk**	**280**	**0,0**	**15,0**	**0,4**	**150**	**120**	**3211**	**100**	**494**	**2717**	**0,85**
-38	38	Hk	300	0,0	15,0	0,4	150	120	**3313**	100	494	2819	0,85
-39	39	Hk	320	0,0	15,0	0,4	150	120	**3415**	100	494	2921	0,86
-40	40	Hk	340	0,0	15,0	0,4	150	120	**3516**	100	494	3022	0,86

Paalun kantavuus puristinkairaus-/puristin-heijarikairausvastuksen perusteella (LCPC)

LCPC method

Projekti	**Zatelliitti**		
Asiakas			
Kohde	**TU-T3**		
Paalun halkaisija	323,9 mm	Paalun pituus 24 m	
Paalun kärjen pinta-ala	0,0823553 m^2	Lähtötaso	5,5
Piiri	1,017046 m	Muunnoskerroin nettolyöntiluvulle $n_{l/0,2m}$ -> qc=	0,83 (Hki/Geo/74/97)

Taso	Syv.	Maalaji	l/0,2 m	qc [Mpa]	Muunnettu qc [Mpa]	kc	α	qsmax [kPa]	**Rk [kN]**	qs [kN/m2]	Qp [kN]	Qs [kN]	Qs/Rk
4	1	Hk	0	0,0	0,0	0,5	30	35	**0**	0	0	0	#DIV/0!
3	2	Hk	0	0,0	0,0	0,5	30	35	**0**	0	0	0	#DIV/0!
2	3	Hk	0	0,0	0,0	0,5	30	35	**0**	0	0	0	#DIV/0!
1	4	Hk	0	0,0	0,0	0,5	30	35	**0**	0	0	0	#DIV/0!
0	5	Hk	0	0,0	0,0	0,5	30	35	**0**	0	0	0	#DIV/0!
-1	6	Hk	0	0,0	0,0	0,5	30	35	**82**	35	82	0	0,00
-2	7	Hk	0	4,0	4,0	0,5	40	35	**200**	100	165	36	0,18
-3	8	Hk	0	4,0	4,0	0,5	40	35	**236**	100	165	71	0,30
-4	9	Hk	0	4,0	4,0	0,5	40	35	**272**	100	165	107	0,39
-5	10	Hk	0	4,0	4,0	0,5	40	35	**307**	100	165	142	0,46
-6	11	Hk	0	4,0	4,0	0,5	40	35	**343**	100	165	178	0,52
-7	12	Hk	0	4,0	4,0	0,5	40	35	**378**	100	165	214	0,56
-8	13	Hk	0	4,0	4,0	0,5	40	35	**414**	100	165	249	0,60
-9	14	sa	0	4,0	4,0	0,5	40	35	**449**	100	165	285	0,63
-10	15	Hk	0	4,0	4,0	0,5	40	35	**485**	100	165	320	0,66
-11	16	Hk	0	4,0	4,0	0,5	40	35	**521**	100	165	356	0,68
-12	17	Hk	0	4,0	4,0	0,5	40	35	**556**	100	165	392	0,70
-13	18	Hk	0	4,0	4,0	0,5	40	35	**592**	100	165	427	0,72
-14	19	Hk	0	4,0	4,0	0,5	40	35	**627**	100	165	463	0,74
-15	20	Hk	0	4,0	4,0	0,5	40	35	**663**	100	165	498	0,75
-16	21	Hk	0	4,0	4,0	0,5	40	35	**699**	100	165	534	0,76
-17	22	Hk	0	4,0	4,0	0,5	40	35	**817**	100	247	570	0,70
-18	23	Hk	40	0,0	8,0	0,5	100	80	**980**	80	329	651	0,66
-19	**24**	**Hk**	**40**	**0,0**	**8,0**	**0,5**	100	**80**	**1062**	**80**	**329**	**732**	**0,69**
-20	25	Hk	40	0,0	8,0	0,5	100	80	**1143**	80	329	814	0,71
-21	26	Hk	40	0,0	8,0	0,5	100	80	**1224**	80	329	895	0,73
-22	27	Hk	40	0,0	8,0	0,5	100	80	**1347**	80	371	976	0,72
-23	28	Hk	50	0,0	10,0	0,5	100	80	**1470**	100	412	1058	0,72
-24	29	Hk	50	0,0	10,0	0,5	100	80	**1592**	100	453	1139	0,72
-25	30	Hk	60	0,0	12,0	0,5	100	120	**1755**	120	494	1261	0,72
-26	31	Hk	60	0,0	12,0	0,5	100	120	**1939**	120	556	1383	0,71
-27	32	Hk	100	0,0	15,0	0,4	150	120	**1979**	100	494	1485	0,75
-28	33	Hk	100	0,0	15,0	0,4	150	120	**2081**	100	494	1587	0,76
-29	34	Hk	100	0,0	15,0	0,4	150	120	**2182**	100	494	1688	0,77
-30	35	Hk	100	0,0	15,0	0,4	150	120	**2284**	100	494	1790	0,78
-31	36	Hk	100	0,0	15,0	0,4	150	120	**2386**	100	494	1892	0,79
-32	37	Hk	100	0,0	15,0	0,4	150	120	**2488**	100	494	1993	0,80
-33	38	Hk	100	0,0	15,0	0,4	150	120	**2589**	100	494	2095	0,81
-34	39	Hk	100	0,0	15,0	0,4	150	120	**2691**	100	494	2197	0,82
-35	40	Hk	340	0,0	15,0	0,4	150	120	**2793**	100	494	2299	0,82

Paalun kantavuus puristinkairaus-/puristin-heijarikairausvastuksen perusteella (LCPC)

LCPC method

Projekti	**Zatelliitti**		
Asiakas			
Kohde	**TU-B2**		
Paalun sivumitta	300 mm	Paalun pituus 23 m	
Paalun kärjen pinta-ala	0,09 m^2	Lähtötaso	5,5
Piiri	1,2 m	Muunnoskerroin nettolyöntiluvulle $n_{l/0,2m}$ -> qc= 0,83	(Hki/Geo/74/97)

Taso	Syv.	Maalaji	l/0,2 m	qc [Mpa]	Muunnettu qc [Mpa]	kc	α	qsmax [kPa]	**Rk [kN]**	qs [kN/m2]	Qp [kN]	Qs [kN]	Qs/Rk
4	1	Hk	0	0,0	0,0	0,5	30	35	**0**	0	0	0	#DIV/0!
3	2	Hk	0	0,0	0,0	0,5	30	35	**0**	0	0	0	#DIV/0!
2	3	Hk	0	0,0	0,0	0,5	30	35	**0**	0	0	0	#DIV/0!
1	4	Hk	0	0,0	0,0	0,5	30	35	**0**	0	0	0	#DIV/0!
0	5	Hk	0	0,0	0,0	0,5	30	35	**0**	0	0	0	#DIV/0!
-1	6	Hk	0	0,0	0,0	0,5	30	35	**90**	35	90	0	0,00
-2	7	Hk	0	4,0	4,0	0,5	40	35	**222**	100	180	42	0,19
-3	8	Hk	0	4,0	4,0	0,5	40	35	**264**	100	180	84	0,32
-4	9	Hk	0	4,0	4,0	0,5	40	35	**306**	100	180	126	0,41
-5	10	Hk	0	4,0	4,0	0,5	40	35	**348**	100	180	168	0,48
-6	11	Hk	0	4,0	4,0	0,5	40	35	**390**	100	180	210	0,54
-7	12	Hk	0	4,0	4,0	0,5	40	35	**432**	100	180	252	0,58
-8	13	Hk	0	4,0	4,0	0,5	40	35	**474**	100	180	294	0,62
-9	14	sa	0	4,0	4,0	0,5	40	35	**516**	100	180	336	0,65
-10	15	Hk	0	4,0	4,0	0,5	40	35	**558**	100	180	378	0,68
-11	16	Hk	0	4,0	4,0	0,5	40	35	**600**	100	180	420	0,70
-12	17	Hk	0	4,0	4,0	0,5	40	35	**642**	100	180	462	0,72
-13	18	Hk	0	4,0	4,0	0,5	40	35	**684**	100	180	504	0,74
-14	19	Hk	0	4,0	4,0	0,5	40	35	**726**	100	180	546	0,75
-15	20	Hk	0	4,0	4,0	0,5	40	35	**768**	100	180	588	0,77
-16	21	Hk	0	4,0	4,0	0,5	40	35	**810**	100	180	630	0,78
-17	22	Hk	0	4,0	4,0	0,5	40	35	**942**	100	270	672	0,71
-18	**23**	**Hk**	**40**	**0,0**	**8,0**	**0,5**	**100**	**80**	**1128**	**80**	**360**	**768**	**0,68**
-19	24	Hk	40	0,0	8,0	0,5	100	80	**1224**	80	360	864	0,71
-20	25	Hk	40	0,0	8,0	0,5	100	80	**1320**	80	360	960	0,73
-21	26	Hk	40	0,0	8,0	0,5	100	80	**1416**	80	360	1056	0,75
-22	27	Hk	40	0,0	8,0	0,5	100	80	**1557**	80	405	1152	0,74
-23	28	Hk	50	0,0	10,0	0,5	100	80	**1698**	100	450	1248	0,73
-24	29	Hk	50	0,0	10,0	0,5	100	80	**1839**	100	495	1344	0,73
-25	30	Hk	60	0,0	12,0	0,5	100	120	**2028**	120	540	1488	0,73
-26	31	Hk	60	0,0	12,0	0,5	100	120	**2240**	120	608	1632	0,73
-27	32	Hk	100	0,0	15,0	0,4	150	120	**2292**	100	540	1752	0,76
-28	33	Hk	100	0,0	15,0	0,4	150	120	**2412**	100	540	1872	0,78
-29	34	Hk	100	0,0	15,0	0,4	150	120	**2532**	100	540	1992	0,79
-30	35	Hk	100	0,0	15,0	0,4	150	120	**2652**	100	540	2112	0,80
-31	36	Hk	100	0,0	15,0	0,4	150	120	**2772**	100	540	2232	0,81
-32	37	Hk	100	0,0	15,0	0,4	150	120	**2892**	100	540	2352	0,81
-33	38	Hk	100	0,0	15,0	0,4	150	120	**3012**	100	540	2472	0,82
-34	39	Hk	100	0,0	15,0	0,4	150	120	**3132**	100	540	2592	0,83
-35	40	Hk	340	0,0	15,0	0,4	150	120	**3252**	100	540	2712	0,83

	Projektin nimi		Suunnittelija
	Zatelliitin koepaalutus		Päivämäärä
ICP-metodi, arvo 10 päivän kulutta	Kuvaus	Paalu ZET1	Allekirjoitus

Perustuu Pälkommissionin raporttiin 103; Slagna friktionspålar

Paalun pituus	L =	14	[m]					
Betonipaalun sivumita	B =	0	[mm]	arvo 0, jos ei käytössä				
Teräspaalun halkaisija	D =	323,9	[mm]	arvo 0, jos ei käytössä				
Paluun pinnan karkeus	d_h=	0,02		0,03 betonipaalulle 10 päivän jälkeen 0,02 karkeapintaiselle teräspaalulle				
Paalun ekvivalentti säde	R =	162,0	[mm]	D=	323,90	[mm]		
Ilmanpaine	P_a=	100	[kPa]					

Paalun vaippakantavuus	323,4	[kN]	
Paalun kärkikantavuus	86,2	[kN]	(qc tulisi määrittää 1,5*D kärjen
Paalun kokonaiskantavuus	**409,6**	[kN]	ylä-ja alapuolelta, normaalisti
			kuitenkin 1,5*D< 1 m)
Paalun vaippakestävyys vedossa	258,7	[kN]	

Avoimilla teräsputkipaaluilla joudutaan laskentaa ja tuloksia säätämään ekvivalentti säteen avulla, koska paalun lävistäessä maaperän syntyy jännityshäviöitä vaipalla. $R^* = \sqrt{R^2_y - R^2_i}$

$f_m = \sigma'_{rf} \tan \delta_{cv}$ $\sigma'_{rf} = \sigma'_{rc} + \Delta\sigma'_{rd}$ $\sigma'_{rc} = 0{,}029 \cdot q_c \cdot (\sigma'_{v0} / P_a)^{0{,}13} (h/R)^{-0{,}38}$ $\Delta\sigma'_{rd} = \frac{2 \cdot G \cdot \delta_h}{R}$ $f_{mt} = 0{,}8 \cdot (\sigma'_{rc} + \Delta\sigma'_{rd}) \cdot \tan \delta_{cv}$ $q_s = q_c \cdot (1\text{-}0{,}5 \cdot \log \frac{D}{D_{CPT}})$

Kärkivastus paaluille D<0,9 m

Taso	Syvyys	q_c	h	h/R	g	u	δ_0	δ'_{v0}	δ'_{rc}	G	$\Delta\sigma'_{rd}$	σ'_{rf}	δ_{cv}	$\tan\delta_{cv}$	f_m	$f_{m-total}$	f_{mt}	$f_{mt-total}$	q_s	f_s
	[m]	[MPa]	[m]		[kN/m³]	[kPa]	[kPa]	[kPa]	[kPa]	[MPa]	[kPa]	[kPa]	[°]		[kN]	[kN]	[kN]	[kN]	[MPa]	[kN]
5	1	1,5	13	80	18	0	18	18	6,58	23,22	5,74	12,31	35,0	0,70	8,62	8,62	6,90	6,90	0,78	64,63
4	2	1	12	74	18	10	36	26	4,74	22,26	5,50	10,24	35,0	0,70	7,17	15,79	5,74	12,63	0,52	43,09
3	3	1	11	68	18	20	54	34	5,07	23,90	5,90	10,98	35,0	0,70	7,69	23,48	6,15	18,78	0,52	43,09
2	4	1,5	10	62	18	30	72	42	8,11	30,41	7,51	15,62	35,0	0,70	10,94	34,41	8,75	27,53	0,78	64,63
1	5	1	9	56	18	40	90	50	5,76	26,26	6,49	12,24	35,0	0,70	8,57	42,99	6,86	34,39	0,52	43,09
0	6	1,5	8	49	18	50	108	58	9,21	33,32	8,23	17,44	35,0	0,70	12,21	55,20	9,77	44,16	0,78	64,63
-1	7	3	7	43	18	60	126	66	19,70	45,07	11,13	30,83	35,0	0,70	21,59	76,79	17,27	61,43	1,57	129,27
-2	8	3	6	37	18	70	144	74	21,20	46,88	11,58	32,78	35,0	0,70	22,95	99,74	18,36	79,79	1,57	129,27
-3	9	5	5	31	18	80	162	82	38,38	55,92	13,81	52,19	35,0	0,70	36,55	136,29	29,24	109,03	2,61	215,45
-4	10	4,5	4	25	18	90	180	90	38,06	56,47	13,95	52,01	35,0	0,70	36,41	172,70	29,13	138,16	2,35	193,90
-5	11	2,5	3	19	18	100	198	98	23,85	48,11	11,88	35,73	35,0	0,70	25,02	197,72	20,01	158,18	1,31	107,72
-6	12	6	2	12	18	110	216	106	67,45	64,35	15,89	83,35	35,0	0,70	58,36	256,08	46,69	204,87	3,14	258,54
-7	13	2	1	8	18	120	234	114	26,77	45,65	11,27	38,04	35,0	0,70	26,64	282,72	21,31	226,18	1,05	86,18
-8	14	2,5	0	8	18	130	252	122	33,76	51,34	12,68	46,44	35,0	0,70	32,52	315,24	26,01	252,19	1,31	107,72
-9	15	2	-1	8	18	140	270	130	0,00	47,25	11,67	11,67	35,0	0,70	8,17	323,41	6,54	258,73	1,05	86,18
-10	16	2,5	-2	8	18	150	288	138	0,00	53,19	13,14	13,14	35,0	0,70	9,20	332,61	7,36	266,09	1,31	107,72
-11	17	2,5	-3	8	18	160	306	146	0,00	54,04	13,35	13,35	35,0	0,70	9,35	341,96	7,48	273,56	1,31	107,72
-12	18	3	-4	8	18	170	324	154	0,00	59,27	14,64	14,64	35,0	0,70	10,25	352,21	8,20	281,76	1,57	129,27
-13	19	1,2	-5	8	18	180	342	162	0,00	37,28	9,21	9,21	35,0	0,70	6,45	358,65	5,16	286,92	0,63	51,71
-14	20	1,2	-6	8	18	190	360	170	0,00	37,61	9,29	9,29	35,0	0,70	6,50	365,16	5,20	292,13	0,63	51,71
-15	21	1,5	-7	8	18	200	378	178	0,00	43,54	10,75	10,75	35,0	0,70	7,53	372,69	6,02	298,15	0,78	64,63
-16	22	2,2	-8	8	18	210	396	186	0,00	54,24	13,40	13,40	35,0	0,70	9,38	382,07	7,50	305,65	1,15	94,80
-17	23	1,7	-9	8	18	220	414	194	0,00	47,68	11,78	11,78	35,0	0,70	8,25	390,31	6,60	312,25	0,89	73,25
-18	24	1,7	-10	8	18	230	432	202	0,00	48,09	11,88	11,88	35,0	0,70	8,32	398,63	6,65	318,90	0,89	73,25
-19	25	1,8	-11	8	18	240	450	210	0,00	50,10	12,37	12,37	35,0	0,70	8,66	407,29	6,93	325,84	0,94	77,56
-20	26	1,7	-12	8	18	250	468	218	0,00	48,86	12,07	12,07	35,0	0,70	8,45	415,75	6,76	332,60	0,89	73,25
-21	27	1,9	-13	8	18	260	486	226	0,00	52,49	12,96	12,96	35,0	0,70	9,08	424,82	7,26	339,86	0,99	81,87
-22	28	3,5	-14	8	18	270	504	234	0,00	71,43	17,64	17,64	35,0	0,70	12,35	437,18	9,88	349,74	1,83	150,81
-22	29	6	-15	8	18	280	522	242	0,00	87,45	21,60	21,60	35,0	0,70	15,12	452,30	12,10	361,84	3,14	258,54
-23	30	8	-16	8	18	290	540	250	0,00	95,65	23,62	23,62	35,0	0,70	16,54	468,84	13,23	375,07	4,18	344,71
-24	31	8	-17	8	18	300	558	258	0,00	96,79	23,91	23,91	35,0	0,70	16,74	485,58	13,39	388,46	4,18	344,71
-25	32	8	-18	8	18	310	576	266	0,00	97,91	24,18	24,18	35,0	0,70	16,93	502,51	13,55	402,01	4,18	344,71
-26	33	8	-19	8	18	320	594	274	0,00	99,00	24,45	24,45	35,0	0,70	17,12	519,63	13,70	415,71	4,18	344,71
-27	34	8	-20	8	18	330	612	282	0,00	100,07	24,72	24,72	35,0	0,70	17,31	536,94	13,84	429,55	4,18	344,71
-28	35	8	-21	8	18	340	630	290	0,00	101,11	24,97	24,97	35,0	0,70	17,49	554,43	13,99	443,54	4,18	344,71
-29	36	8	-22	8	18	320	648	328	0,00	105,80	26,13	26,13	25,0	0,47	12,19	566,61	9,75	453,29	4,18	344,71
-30	37	8	-23	8	18	330	666	336	0,00	106,74	26,36	26,36	25,0	0,47	12,29	578,91	9,83	463,13	4,18	344,71
-31	38	8	-24	8	21	340	687	347	0,00	107,99	26,67	26,67	25,0	0,47	12,44	591,34	9,95	473,08	4,18	344,71
-32	39	8	-25	8	21	350	708	358	0,00	109,22	26,98	26,98	25,0	0,47	12,58	603,92	10,06	483,14	4,18	344,71
-33	40	8	-26	8	21	360	729	369	0,00	110,41	27,27	27,27	25,0	0,47	12,72	616,64	10,17	493,31	4,18	344,71
-34	41	8	-27	8	21	370	750	380	0,00	111,58	27,56	27,56	25,0	0,47	12,85	629,49	10,28	503,59	4,18	344,71
-35	42	8	-28	8	21	380	771	391	0,00	112,72	27,84	27,84	25,0	0,47	12,98	642,47	10,39	513,98	4,18	344,71
-36	43	8	-29	8	21	390	792	402	0,00	113,84	28,12	28,12	25,0	0,47	13,11	655,59	10,49	524,47	4,18	344,71
-37	44	8	-30	8	21	400	813	413	0,00	114,94	28,39	28,39	25,0	0,47	13,24	668,82	10,59	535,06	4,18	344,71
-38	45	8	-31	8	21	410	834	424	0,00	116,01	28,65	28,65	25,0	0,47	13,36	682,18	10,69	545,75	4,18	344,71
-39	46	8	-32	8	21	420	855	435	0,00	117,05	28,91	28,91	25,0	0,47	13,48	695,67	10,79	556,53	4,18	344,71
-40	47	8	-33	8	21	430	876	446	0,00	118,08	29,17	29,17	25,0	0,47	13,60	709,27	10,88	567,41	4,18	344,71
-41	48	8	-34	8	21	440	897	457	0,00	119,09	29,41	29,41	25,0	0,47	13,72	722,98	10,97	578,38	4,18	344,71
-42	49	8	-35	8	21	450	918	468	0,00	120,08	29,66	29,66	25,0	0,47	13,83	736,81	11,06	589,45	4,18	344,71
-43	50	8	-36	8	21	460	939	479	0,00	121,05	29,90	29,90	25,0	0,47	13,94	750,75	11,15	600,60	4,18	344,71

Projekti	Koepaalutus	
Kohde	Zatelliitti	
Paalu nro.	ZPT4	
Paalun pituus	37	m
Paalumateriaali	*Teräs*	
Paalun halkaisija D	323,9	mm
Paalun kärjen pinta-ala	0,082	m²
Paalun pl. piiri	1,02	m

20*D = 6,478 m

Alle 400 mm paaluille (323,9 mm)

Vaippavastukselle suurin sallittu arvo on 120...150 kN/m2

Kärkivastukselle suurin arvo on 15 MN/m2

Syvyys	Taso	Kitkakulma	N_q	γ	$\sigma'_{v;b}$	q_b	$R_{b;cal}$	$K_s tan\varphi_a$	$\sigma'_{v;i}$	$q_{s;i}$	R_s	$R_{c;cal}$
m		[°]		[kN/m³]	MPa	MPa	MN			kPa	MN	MN
1	6	28	25	18,5	0,0185	0,4625	0,0381	0,17	0,0185	3,145	0,0032	**0,04**
2	5	28	25	18,5	0,037	0,925	0,0762	0,17	0,037	6,29	0,0096	**0,09**
3	4	28	25	17	0,054	1,35	0,1112	0,17	0,054	9,18	0,0189	**0,13**
4	3	28	25	17	0,071	1,775	0,1463	0,17	0,071	12,07	0,0312	**0,18**
5	2	28	25	19	0,09	2,25	0,1854	0,17	0,09	15,3	0,0468	**0,23**
6	1	28	25	19	0,109	2,725	0,2245	0,17	0,109	18,53	0,0656	**0,29**
7	0	28	25	19	0,109	2,725	0,2245	0,17	0,109	18,53	0,0845	**0,31**
8	-1	30	35	19	0,109	3,815	0,3143	0,25	0,109	27,25	0,1122	**0,43**
9	-2	30	35	19	0,109	3,815	0,3143	0,25	0,109	27,25	0,1400	**0,45**
10	-3	30	35	19	0,109	3,815	0,3143	0,25	0,109	27,25	0,1677	**0,48**
11	-4	30	35	19	0,109	3,815	0,3143	0,25	0,109	27,25	0,1954	**0,51**
12	-5	30	35	19	0,109	3,815	0,3143	0,25	0,109	27,25	0,2231	**0,54**
13	-6	30	35	19	0,109	3,815	0,3143	0,25	0,109	27,25	0,2509	**0,57**
14	-7	30	35	19	0,109	3,815	0,3143	0,25	0,109	27,25	0,2786	**0,59**
15	-8	30	35	19	0,109	3,815	0,3143	0,25	0,109	27,25	0,3063	**0,62**
16	-9	30	35	19	0,109	3,815	0,3143	0,25	0,109	27,25	0,3341	**0,65**
17	-10	30	35	19	0,109	3,815	0,3143	0,25	0,109	27,25	0,3618	**0,68**
18	-11	30	35	19	0,109	3,815	0,3143	0,25	0,109	27,25	0,3895	**0,70**
19	-12	30	35	19	0,109	3,815	0,3143	0,25	0,109	27,25	0,4172	**0,73**
20	-13	30	35	19	0,109	3,815	0,3143	0,25	0,109	27,25	0,4450	**0,76**
21	-14	30	35	19	0,109	3,815	0,3143	0,25	0,109	27,25	0,4727	**0,79**
22	-15	30	35	19	0,109	3,815	0,3143	0,25	0,109	27,25	0,5004	**0,81**
23	-16	36	90	19	0,109	9,81	0,8083	0,45	0,109	49,05	0,5503	**1,36**
24	-17	36	90	19	0,109	9,81	0,8083	0,45	0,109	49,05	0,6003	**1,41**
25	-18	36	90	19	0,109	9,81	0,8083	0,45	0,109	49,05	0,6502	**1,46**
26	-19	36	90	19	0,109	9,81	0,8083	0,45	0,109	49,05	0,7001	**1,51**
27	-20	36	90	19	0,109	9,81	0,8083	0,45	0,109	49,05	0,7500	**1,56**
28	-21	36	90	19	0,109	9,81	0,8083	0,45	0,109	49,05	0,7999	**1,61**
29	-22	36	90	19	0,109	9,81	0,8083	0,45	0,109	49,05	0,8498	**1,66**
30	-23	36	90	19	0,109	9,81	0,8083	0,45	0,109	49,05	0,8997	**1,71**
31	-24	36	90	19	0,109	9,81	0,8083	0,45	0,109	49,05	0,9496	**1,76**
32	-25	36	90	19	0,109	9,81	0,8083	0,45	0,109	49,05	0,9995	**1,81**
33	-26	36	90	19	0,109	9,81	0,8083	0,45	0,109	49,05	1,0495	**1,86**
34	-27	40	185	19	0,109	15	1,236	0,45	0,109	49,05	1,0994	**2,34**
35	-28	40	185	19	0,109	15	1,236	0,45	0,109	49,05	1,1493	**2,39**
36	-29	40	185	19	0,109	15	1,236	0,45	0,109	49,05	1,1992	**2,44**
37	**-30**	**40**	185	**19**	**0,109**	**15**	**1,236**	**0,45**	**0,109**	**49,05**	**1,2491**	**2,49**
38	-31	40	185	19	0,109	15	1,236	0,45	0,109	49,05	1,2990	**2,53**

Projekti	Koepaalutus	
Kohde	Zatelliitti	
Paalu nro.	ZPT4	
Paalun pituus	37	m
Paalumateriaali	*Teräs*	
Paalun halkaisija D	323,9	mm
Paalun kärjen pinta-ala	0,082	m²
Paalun pl. piiri	1,02	m

10*D = 3,239 m

Alle 400 mm paaluille (323,9 mm)

Vaippavastukselle suurin sallittu arvo on 120...150 kN/m2

Kärkivastukselle suurin arvo on 15 MN/m2

Syvyys	Taso	Kitkakulma	N_q	γ	$\sigma'_{v;b}$	q_b	$R_{b;cal}$	$K_s tan\varphi_a$	$\sigma'_{v;i}$	$q_{s;i}$	R_s	$R_{c;cal}$
m		[°]		[kN/m³]	MPa	MPa	MN			kPa	MN	MN
1	6	28	25	18,5	0,0185	0,4625	0,0381	0,17	0,0185	3,145	0,0032	**0,04**
2	5	28	25	18,5	0,037	0,925	0,0762	0,17	0,037	6,29	0,0096	**0,09**
3	4	28	25	17	0,054	1,35	0,1112	0,17	0,054	9,18	0,0189	**0,13**
4	3	28	25	17	0,054	1,35	0,1112	0,17	0,054	9,18	0,0283	**0,14**
5	2	28	25	19	0,054	1,35	0,1112	0,17	0,054	9,18	0,0376	**0,15**
6	1	28	25	19	0,055	1,375	0,1133	0,17	0,055	9,35	0,0471	**0,16**
7	0	28	25	19	0,057	1,425	0,1174	0,17	0,057	9,69	0,0570	**0,17**
8	-1	30	35	19	0,057	1,995	0,1644	0,25	0,057	14,25	0,0715	**0,24**
9	-2	30	35	19	0,057	1,995	0,1644	0,25	0,057	14,25	0,0860	**0,25**
10	-3	30	35	19	0,057	1,995	0,1644	0,25	0,057	14,25	0,1005	**0,26**
11	-4	30	35	19	0,057	1,995	0,1644	0,25	0,057	14,25	0,1150	**0,28**
12	-5	30	35	19	0,057	1,995	0,1644	0,25	0,057	14,25	0,1295	**0,29**
13	-6	30	35	19	0,057	1,995	0,1644	0,25	0,057	14,25	0,1440	**0,31**
14	-7	30	35	19	0,057	1,995	0,1644	0,25	0,057	14,25	0,1585	**0,32**
15	-8	30	35	19	0,057	1,995	0,1644	0,25	0,057	14,25	0,1730	**0,34**
16	-9	30	35	19	0,057	1,995	0,1644	0,25	0,057	14,25	0,1875	**0,35**
17	-10	30	35	19	0,057	1,995	0,1644	0,25	0,057	14,25	0,2020	**0,37**
18	-11	30	35	19	0,057	1,995	0,1644	0,25	0,057	14,25	0,2165	**0,38**
19	-12	30	35	19	0,057	1,995	0,1644	0,25	0,057	14,25	0,2310	**0,40**
20	-13	30	35	19	0,057	1,995	0,1644	0,25	0,057	14,25	0,2455	**0,41**
21	-14	30	35	19	0,057	1,995	0,1644	0,25	0,057	14,25	0,2600	**0,42**
22	-15	30	35	19	0,057	1,995	0,1644	0,25	0,057	14,25	0,2745	**0,44**
23	-16	36	90	19	0,057	5,13	0,4227	0,45	0,057	25,65	0,3006	**0,72**
24	-17	36	90	19	0,057	5,13	0,4227	0,45	0,057	25,65	0,3267	**0,75**
25	-18	36	90	19	0,057	5,13	0,4227	0,45	0,057	25,65	0,3528	**0,78**
26	-19	36	90	19	0,057	5,13	0,4227	0,45	0,057	25,65	0,3789	**0,80**
27	-20	36	90	19	0,057	5,13	0,4227	0,45	0,057	25,65	0,4050	**0,83**
28	-21	36	90	19	0,057	5,13	0,4227	0,45	0,057	25,65	0,4311	**0,85**
29	-22	36	90	19	0,057	5,13	0,4227	0,45	0,057	25,65	0,4572	**0,88**
30	-23	36	90	19	0,057	5,13	0,4227	0,45	0,057	25,65	0,4833	**0,91**
31	-24	36	90	19	0,057	5,13	0,4227	0,45	0,057	25,65	0,5094	**0,93**
32	-25	36	90	19	0,057	5,13	0,4227	0,45	0,057	25,65	0,5355	**0,96**
33	-26	36	90	19	0,057	5,13	0,4227	0,45	0,057	25,65	0,5616	**0,98**
34	-27	40	185	19	0,057	10,545	0,8689	0,45	0,057	25,65	0,5877	**1,46**
35	-28	40	185	19	0,057	10,545	0,8689	0,45	0,057	25,65	0,6138	**1,48**
36	-29	40	185	19	0,057	10,545	0,8689	0,45	0,057	25,65	0,6399	**1,51**
37	**-30**	**40**	**185**	**19**	**0,057**	**10,545**	**0,8689**	**0,45**	**0,057**	**25,65**	**0,6660**	1,53
38	-31	40	185	19	0,057	10,545	0,8689	0,45	0,057	25,65	0,6921	**1,56**

Projekti	Koepaalutus	
Kohde	Zatelliitti	
Paalu nro.	ZPT4	
Paalun pituus	37	m
Paalumateriaali	*Teräs*	
Paalun halkaisija D	323,9	mm
Paalun kärjen pinta-ala	0,082	m²
Paalun pl. piiri	1,02	m

Alle 400 mm paaluille (323,9 mm)

Vaippavastukselle suurin sallittu arvo on 120...150 kN/m2

Kärkivastukselle suurin arvo on 15 MN/m2

Syvyys m	Taso	Kitkakulma [°]	N_q	γ [kN/m³]	$\sigma'_{v;b}$ MPa	q_b MPa	$R_{b;cal}$ MN	$K_s tan\varphi_a$	$\sigma'_{v;i}$	$q_{s;i}$ kPa	R_s MN	$R_{c;cal}$ MN
1	6	28	25	18,5	0,0185	0,4625	0,0381	0,17	0,0185	3,145	0,0032	**0,04**
2	5	28	25	18,5	0,037	0,925	0,0762	0,17	0,037	6,29	0,0096	**0,09**
3	4	28	25	17	0,054	1,35	0,1112	0,17	0,054	9,18	0,0189	**0,13**
4	3	28	25	17	0,071	1,775	0,1463	0,17	0,071	12,07	0,0312	**0,18**
5	2	28	25	19	0,09	2,25	0,1854	0,17	0,09	15,3	0,0468	**0,23**
6	1	28	25	19	0,109	2,725	0,2245	0,17	0,109	18,53	0,0656	**0,29**
7	0	28	25	19	0,128	3,2	0,2637	0,17	0,128	21,76	0,0878	**0,35**
8	-1	30	35	19	0,147	5,145	0,4239	0,25	0,147	36,75	0,1252	**0,55**
9	-2	30	35	19	0,166	5,81	0,4787	0,25	0,166	41,5	0,1674	**0,65**
10	-3	30	35	19	0,185	6,475	0,5335	0,25	0,185	46,25	0,2145	**0,75**
11	-4	30	35	19	0,204	7,14	0,5883	0,25	0,204	51	0,2664	**0,85**
12	-5	30	35	19	0,223	7,805	0,6431	0,25	0,223	55,75	0,3231	**0,97**
13	-6	30	35	19	0,242	8,47	0,6979	0,25	0,242	60,5	0,3847	**1,08**
14	-7	30	35	19	0,261	9,135	0,7527	0,25	0,261	65,25	0,4511	**1,20**
15	-8	30	35	19	0,28	9,8	0,8075	0,25	0,28	70	0,5223	**1,33**
16	-9	30	35	19	0,299	10,465	0,8623	0,25	0,299	74,75	0,5984	**1,46**
17	-10	30	35	19	0,318	11,13	0,9171	0,25	0,318	79,5	0,6792	**1,60**
18	-11	30	35	19	0,337	11,795	0,9719	0,25	0,337	84,25	0,7650	**1,74**
19	-12	30	35	19	0,356	12,46	1,0267	0,25	0,356	89	0,8555	**1,88**
20	-13	30	35	19	0,375	13,125	1,0815	0,25	0,375	93,75	0,9509	**2,03**
21	-14	30	35	19	0,394	13,79	1,1363	0,25	0,394	98,5	1,0512	**2,19**
22	-15	30	35	19	0,413	14,455	1,191	0,25	0,413	103,25	1,1562	**2,35**
23	-16	36	90	19	0,432	15	1,236	0,45	0,432	150	1,3089	**2,54**
24	-17	36	90	19	0,451	15	1,236	0,45	0,451	150	1,4615	**2,70**
25	-18	36	90	19	0,47	15	1,236	0,45	0,47	150	1,6141	**2,85**
26	-19	36	90	19	0,489	15	1,236	0,45	0,489	150	1,7668	**3,00**
27	-20	36	90	19	0,508	15	1,236	0,45	0,508	150	1,9194	**3,16**
28	-21	36	90	19	0,527	15	1,236	0,45	0,527	150	2,0720	**3,31**
29	-22	36	90	19	0,546	15	1,236	0,45	0,546	150	2,2247	**3,46**
30	-23	36	90	19	0,565	15	1,236	0,45	0,565	150	2,3773	**3,61**
31	-24	36	90	19	0,584	15	1,236	0,45	0,584	150	2,5299	**3,77**
32	-25	36	90	19	0,603	15	1,236	0,45	0,603	150	2,6826	**3,92**
33	-26	36	90	19	0,622	15	1,236	0,45	0,622	150	2,8352	**4,07**
34	-27	40	185	19	0,641	15	1,236	0,45	0,641	150	2,9878	**4,22**
35	-28	40	185	19	0,66	15	1,236	0,45	0,66	150	3,1405	**4,38**
36	-29	40	185	19	0,679	15	1,236	0,45	0,679	150	3,2931	**4,53**
37	**-30**	**40**	**185**	**19**	**0,698**	**15**	**1,236**	**0,45**	**0,698**	**150**	**3,4457**	**4,68**
38	-31	40	185	19	0,717	15	1,236	0,45	0,717	150	3,5984	**4,83**

Projekti	Koepaalutus	
Kohde	Tuuliharju	
Paalu nro.	TU-T3	
Paalun pituus	24	m
Paalumateriaali	*Teräs*	
Paalun halkaisija D	323,9	mm
Paalun kärjen pinta-ala	0,082	m²
Paalun pl. piiri	1,02	m

Alle 400 mm paaluille (323,9 mm)

Vaippavastukselle suurin sallittu arvo on 120...150 kN/m2

Kärkivastukselle suurin arvo on 15 MN/m2

Syvyys m	Taso	Kitkakulma [°]	N_q	γ [kN/m³]	$\sigma'_{v;b}$ MPa	q_b MPa	$R_{b;cal}$ MN	$K_s tan\varphi_a$	$\sigma'_{v;i}$	$q_{s;i}$ kPa	R_s MN	$R_{c;d}$ MN
1	4	28	25	18,5	0,0185	0,4625	0,0381	0,17	0,0185	3,145	0,0032	**0,04**
2	3	28	25	18,5	0,037	0,925	0,0762	0,17	0,037	6,29	0,0096	**0,09**
3	2	28	25	17	0,054	1,35	0,1112	0,17	0,054	9,18	0,0189	**0,13**
4	1	28	25	17	0,071	1,775	0,1463	0,17	0,071	12,07	0,0312	**0,18**
5	0	28	25	19	0,09	2,25	0,1854	0,17	0,09	15,3	0,0468	**0,23**
6	-1	28	25	19	0,109	2,725	0,2245	0,17	0,109	18,53	0,0656	**0,29**
7	-2	28	25	19	0,128	3,2	0,2637	0,17	0,128	21,76	0,0878	**0,35**
8	-3	28	25	19	0,147	3,675	0,3028	0,17	0,147	24,99	0,1132	**0,42**
9	-4	28	25	19	0,166	4,15	0,3419	0,17	0,166	28,22	0,1419	**0,48**
10	-5	28	25	19	0,185	4,625	0,3811	0,17	0,185	31,45	0,1739	**0,56**
11	-6	28	25	19	0,204	5,1	0,4202	0,17	0,204	34,68	0,2092	**0,63**
12	-7	28	25	19	0,223	5,575	0,4594	0,17	0,223	37,91	0,2478	**0,71**
13	-8	28	25	19	0,242	6,05	0,4985	0,17	0,242	41,14	0,2897	**0,79**
14	-9	28	25	19	0,261	6,525	0,5376	0,17	0,261	44,37	0,3348	**0,87**
15	-10	28	25	19	0,28	7	0,5768	0,17	0,28	47,6	0,3832	**0,96**
16	-11	28	25	19	0,299	7,475	0,6159	0,17	0,299	50,83	0,4350	**1,05**
17	-12	28	25	19	0,318	7,95	0,6551	0,17	0,318	54,06	0,4900	**1,15**
18	-13	28	25	19	0,337	8,425	0,6942	0,17	0,337	57,29	0,5483	**1,24**
19	-14	28	25	19	0,356	8,9	0,7333	0,17	0,356	60,52	0,6099	**1,34**
20	-15	28	25	19	0,375	9,375	0,7725	0,17	0,375	63,75	0,6747	**1,45**
21	-16	36	90	19	0,394	15	1,236	0,45	0,394	150	0,8274	**2,06**
22	-17	36	90	19	0,413	15	1,236	0,45	0,413	150	0,9800	**2,22**
23	-18	36	90	19	0,432	15	1,236	0,45	0,432	150	1,1326	**2,37**
24	-19	36	90	19	0,451	15	1,236	0,45	0,451	150	1,2853	**2,52**
25	-20	36	90	19	0,47	15	1,236	0,45	0,47	150	1,4379	**2,67**
26	-21	36	90	19	0,489	15	1,236	0,45	0,489	150	1,5905	**2,83**
27	-22	36	90	19	0,508	15	1,236	0,45	0,508	150	1,7432	**2,98**
28	-23	36	90	19	0,527	15	1,236	0,45	0,527	150	1,8958	**3,13**

Projekti	Koepaalutus	
Kohde	Tuuliharju	
Paalu nro.	TU-B2	
Paalun pituus	23	m
Paalumateriaali	*Teräsbetoni*	
Paalun halkaisija D	300	mm
Paalun kärjen pinta-ala	0,090	m²
Paalun pl. piiri	1,20	m

Alle 400 mm paaluille (323,9 mm)

Vaippavastukselle suurin sallittu arvo on 120...150 kN/m2

Kärkivastukselle suurin arvo on 15 MN/m2

Syvyys	Taso	Kitkakulma	N_q	γ	$\sigma'_{v;b}$	q_b	$R_{b;cal}$	$K_s tan\varphi_a$	$\sigma'_{v;i}$	$q_{s;i}$	R_s	$R_{c;d}$
m		[°]		[kN/m³]	MPa	MPa	MN			kPa	MN	MN
1	4	28	25	18,5	0,0185	0,4625	0,0416	0,17	0,0185	3,145	0,0038	**0,05**
2	3	28	25	18,5	0,037	0,925	0,0833	0,17	0,037	6,29	0,0113	**0,09**
3	2	28	25	17	0,054	1,35	0,1215	0,17	0,054	9,18	0,0223	**0,14**
4	1	28	25	17	0,071	1,775	0,1598	0,17	0,071	12,07	0,0368	**0,20**
5	0	28	25	19	0,09	2,25	0,2025	0,17	0,09	15,3	0,0552	**0,26**
6	-1	28	25	19	0,109	2,725	0,2453	0,17	0,109	18,53	0,0774	**0,32**
7	-2	28	25	19	0,128	3,2	0,288	0,17	0,128	21,76	0,1035	**0,39**
8	-3	28	25	19	0,147	3,675	0,3308	0,17	0,147	24,99	0,1335	**0,46**
9	-4	28	25	19	0,166	4,15	0,3735	0,17	0,166	28,22	0,1674	**0,54**
10	-5	28	25	19	0,185	4,625	0,4163	0,17	0,185	31,45	0,2051	**0,62**
11	-6	28	25	19	0,204	5,1	0,459	0,17	0,204	34,68	0,2467	**0,71**
12	-7	28	25	19	0,223	5,575	0,5018	0,17	0,223	37,91	0,2922	**0,79**
13	-8	28	25	19	0,242	6,05	0,5445	0,17	0,242	41,14	0,3416	**0,89**
14	-9	28	25	19	0,261	6,525	0,5873	0,17	0,261	44,37	0,3948	**0,98**
15	-10	28	25	19	0,28	7	0,63	0,17	0,28	47,6	0,4520	**1,08**
16	-11	28	25	19	0,299	7,475	0,6728	0,17	0,299	50,83	0,5130	**1,19**
17	-12	28	25	19	0,318	7,95	0,7155	0,17	0,318	54,06	0,5778	**1,29**
18	-13	28	25	19	0,337	8,425	0,7583	0,17	0,337	57,29	0,6466	**1,40**
19	-14	28	25	19	0,356	8,9	0,801	0,17	0,356	60,52	0,7192	**1,52**
20	-15	28	25	19	0,375	9,375	0,8438	0,17	0,375	63,75	0,7957	**1,64**
21	-16	36	90	19	0,394	15	1,35	0,45	0,394	150	0,9757	**2,33**
22	-17	36	90	19	0,413	15	1,35	0,45	0,413	150	1,1557	**2,51**
23	-18	36	90	19	0,432	15	1,35	0,45	0,432	150	1,3357	**2,69**
24	-19	36	90	19	0,451	15	1,35	0,45	0,451	150	1,5157	**2,87**
25	-20	36	90	19	0,47	15	1,35	0,45	0,47	150	1,6957	**3,05**
26	-21	36	90	19	0,489	15	1,35	0,45	0,489	150	1,8757	**3,23**
27	-22	36	90	19	0,508	15	1,35	0,45	0,508	150	2,0557	**3,41**
28	-23	36	90	19	0,527	15	1,35	0,45	0,527	150	2,2357	**3,59**

Paalun kantavuus puristinkairaus-/puristin-heijarikairausvastuksen perusteella (LCPC)

LCPC method

Projekti	**Zatelliitti koepaalutus**		
Asiakas			
Kohde	**ZET1**		
Paalun halkaisija	323,9 mm	Elementin pituus 14 m	
Paalun kärjen pinta-ala	0,0823553 m^2	Lähtötaso	7
Piiri	1,017046 m	Muunnoskerroin $n_{l/0,2m}$ -> qc=	0,83

Taso	Syv.	Maalaji	l/0,2 m	qc [Mpa]	Muunnettu qc [Mpa]	kc	α	qsmax [kPa]	**Rk [kN]**	qs [kN/m2]	Qp [kN]	Qs [kN]	Qs/Rk
5	1	Hk	0	1,5	1,5	0,5	60	35	**77**	25	51	25	0,33
4	2	Hk	0	1,0	1,0	0,5	60	35	**84**	17	41	42	0,51
3	3	Hk	0	1,0	1,0	0,5	60	35	**111**	17	51	59	0,54
2	4	Hk	0	1,5	1,5	0,5	60	35	**136**	25	51	85	0,62
1	5	Hk	0	1,0	1,0	0,5	60	35	**153**	17	51	102	0,66
0	6	Hk	0	1,5	1,5	0,5	60	35	**220**	35	93	127	0,58
-1	7	Si	0	3,0	3,0	0,5	60	35	**286**	50	124	163	0,57
-2	8	Si	0	3,0	3,0	0,5	60	35	**363**	50	165	198	0,55
-3	9	Si	0	5,0	5,0	0,5	60	35	**430**	83	196	234	0,54
-4	10	Si	0	4,5	4,5	0,5	60	35	**414**	75	144	270	0,65
-5	11	Si	0	2,5	2,5	0,5	60	35	**480**	42	175	305	0,64
-6	12	Si	0	6,0	6,0	0,5	60	80	**551**	100	165	386	0,70
-7	13	Si	0	2,0	2,0	0,5	60	35	**513**	33	93	420	0,82
-8	14	Si	0	2,5	2,5	0,5	60	35	**549**	42	93	456	0,83
-9	**15**	**Si**	**0**	**2,0**	**2,0**	**0,5**	**60**	**35**	**583**	**33**	**93**	**490**	**0,84**
-10	16	Si	0	2,5	2,5	0,5	60	35	**628**	42	103	525	0,84
-11	17	Si	0	2,5	2,5	0,5	60	35	**674**	42	113	561	0,83
-12	18	Si	0	3,0	3,0	0,5	60	35	**658**	50	62	597	0,91
-13	19	Si	0	0,0	0,0	0,5	60	35	**597**	0	0	597	1,00
-14	20	Si	0	0,0	0,0	0,5	60	35	**597**	0	0	597	1,00
-15	21	Si	0	0,0	0,0	0,5	60	35	**597**	0	0	597	1,00
-16	22	Si	0	0,0	0,0	0,5	60	35	**597**	0	0	597	1,00
-17	23	Si	0	0,0	0,0	0,5	60	35	**597**	0	0	597	1,00
-18	24	Si	0	0,0	0,0	0,5	60	35	**597**	0	0	597	1,00
-19	25	Si	0	0,0	0,0	0,5	60	35	**597**	0	0	597	1,00
-20	26	Si	0	0,0	0,0	0,5	60	35	**597**	0	0	597	1,00
-21	27	Hk	0	0,0	0,0	0,5	200	120	**597**	0	0	597	1,00
-22	28	Hk	0	0,0	0,0	0,5	200	120	**597**	0	0	597	1,00
-23	29	Hk	0	0,0	0,0	0,5	200	120	**597**	0	0	597	1,00
-24	30	Hk	0	0,0	0,0	0,5	200	120	**597**	0	0	597	1,00
-25	31	Hk	0	0,0	0,0	0,5	200	120	**597**	0	0	597	1,00
-26	32	Hk	0	0,0	0,0	0,5	200	120	**597**	0	0	597	1,00
-27	33	Hk	0	0,0	0,0	0,5	200	120	**597**	0	0	597	1,00
-28	34	Hk	0	0,0	0,0	0,5	200	120	**597**	0	0	597	1,00
-29	35	Hk	0	0,0	0,0	0,5	200	120	**597**	0	0	597	1,00
-30	36	Hk	0	0,0	0,0	0,5	200	120	**597**	0	0	597	1,00
-31	37	Hk	0	0,0	0,0	0,5	200	120	**597**	0	0	597	1,00
-32	38	Hk	0	0,0	0,0	0,5	200	120	**597**	0	0	597	1,00
-33	39	Hk	0	0,0	0,0	0,5	200	120	**597**	0	0	597	1,00
-34	40	Hk	0	0,0	0,0	0,5	200	120	**597**	0	0	597	1,00

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